National Research Council of Italy

Conference Science, Innovation and Society: achieving Responsible Research and Innovation Rome, November 19-21 2014

The Contribution of Science and Society (FP6) and Science in Society (FP7)

to a Responsible Research and Innovation. A Review

Prepared by the Local Scientific Committee

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The scientific community is facing increasing demands from society at large. It is asked to provide results that conform to greater expectations, to provide innovations for the economic sphere, and to interact as much as possible with stakeholders. But there are growing concerns about the direction taken by new opportunities, up to the point that societal monitoring is becoming a routine. GM foods, DNA manipulation, ICT surveillance, just to cite a few hot topics, are putting fresh dilemmas to society as well as to academia. It is often very difficult to satisfy contrasting requests and to pacify concerns, especially in a period where public budgets have been, especially in Europe, under pressure leading often to substantial cuts to government expenditure.

The European Union has for many years recognized the crucial importance of science, technology and innovation for its prosperity. Already in the March 2000 the European Council in Lisbon launched the ambitious target of making the old continent the largest knowledge-based economy of the world. The European Council in Barcelona in March 2002 further qualified this target, aiming at reaching in the EU a ratio R&D/GDP equal to 3 per cent. Although the target has not yet been reached, there is a general consensus about the fact that the role that science plays in society goes beyond the amount of resources that absorbs. It is equally vital that there are strong interactions with stakeholders in order to understand not only what the scientific and technological fields of greater potential are, but also how societal groups can benefit from them.

The scientific community interacts on a daily basis with a large number of different groups: first, policy-makers and policy advisers, which decide the nature and the amount of resources should be devoted to research; second, the business community, which is looking for knowledge exploitation for its commerce; and third, civil society, which eventually assesses the potentials and dangers associated to innovative know-how and practices. Can a greater integration with these groups help to tune the activities of the scientific community?

The European Union plays a crucial role in integrating scientific activities into the economic, social, cultural and political landscape, by carrying out research in its own centres and by promoting and financing a wide range of scientific, technological and innovative activities. The EU has also tried to provide original forms of organization of scientific and technological activities. From the very beginning, it has promoted collaboration across different countries, within and outside the EU, and it has fostered the integration between the public and the business sectors. The schemes and the programmes promoted have also developed and applied standards and practices to match ethical issues, gender equality, regional cohesion, research integrity, evaluation, to mention just a few. Most of the practices introduced at the European level have been considered and sometimes imitated by EU Member States, by countries in other continents and by other international organizations.

The innovations that the EU has contributed to introduce in the operation of the scientific and technological community are not the results of improvisation. They are often based on reflections carried out by scientists of each discipline and scholars working on research policy, the economics and sociology of science and technology, and what, more generally, can be labelled "the science of science". The European Commission has played a pioneering role in mapping and exploring the new landscape in which the knowledge community is operating. Promoting and financing a large battery of activities in emerging areas, the European Commission has also

managed to identify new concerns and to explore how the scientific and technological community could respond to unexpected challenges.

This Report, associated to the Conference Science, Innovation and Society: achieving Responsible Research and Innovation, to be held in Rome on 19-21 November 2014, wishes to emphasise what has been done, also with a view to learn from the past and to prepare for the future. The aim of the Conference is to explore these issues in light of the role played by the European Union through its Framework Programmes and the on-going Horizon 2020 Programme. In particular, the Conference will discuss the research carried out through the schemes "Science and Society" (SaS-FP6) and "Science for Society" (SiS-FP7). These activities have been crucial to a better organization of the whole European Research Area, and have provided inspiration to the scientific and technological research carried out in member countries as well as in other regions of the world. In light of the fact that the Horizon 2020 Work Programme (2014-2015) has already allocated 91 million of Euros to the programme "Science with and for Society" (SwafS-Horizon 2020), it is crucial to reflect on what has been already learnt and what will be the future prospective. Among the objectives of the Conference are:

(a) to garner analysis, recommendations and best practices;

(b) to provide a platform for stakeholders from member states and others to discuss further developments in Responsible Research and Innovation framework;

(c) to federate the Science in Society Community and provide input for future collaboration within 'Science with and for Society';

(d) to present the international perspective of Science in Society projects over the FP6 and FP7, and further discuss and reflect on the international dimension of Science in Society.

This report provides a contribution to achieve the Conference objectives. It is devoted to review the activities that constitutes the background of the Conference, namely the activities carried out by SaS-FP6 (2002-2006) and SiS-FP7 (2007-2013), identifying the main priorities and achievements, and to single out the projects that, in our judgement, could be useful to plan future activities.

The changing names that the Framework Programmes have used are already "programmatic": the word "and" used in FP6 indicates that the two sets, science on the one hand and society on the other hand, were somehow separated and that they needed to be combined. The word "in" used in FP7 calls for a greater integration within the two. Horizon 2020 has become even more explicit, demanding to the scientific community to be at the service of society at large. Under these apparently small linguistic changes it is possible to trace how the relationship between science and society has evolved in a relatively short time.

To classify and categorize the activities promoted, carried out and funded over 14 years has not been easy. The Conference and this Report are organized around six principal thematic keys: (1) Public Engagement, (2) Gender Equality, (3) Science Education, (4) Open Access, (5) Ethics, and (6) Governance of Science. We are well aware that they do not satisfactorily describe all projects and that there are projects that do deserve to belong to more than one key. However, we assume that the six keys are indicative of the core areas in which the activities promoted by the Commission have been distinguished.

The European Commission is, of course, not alone in addressing these issues. National governments, including EU member countries, the business sector and other institutions are often discussed similar questions and provided a wealth of analyses in order to shape science, technology and innovation in an evolving social and economic context. An attempt to report some of these activites is provided in the last chapter, devoted to Global Trends in Science in Society. The European Commission itself has not only offered inspiration for some of these activities, but has fostered international cooperation with non-EU countries and institutions also in the specific domain of the "science of science".

Many of the scholars that have contributed to SaS-FP6 and SiS-FP7, and that will contribute to SwafS-Horizon

2020, will attend the Conference. This will give us the opportunity to gather additional information about the work they have carried out and to receive original feed-back. The analysis of what has been done in the past is specifically designed to capitalize from learnt lessons but also to envisage a better role for science, technology and innovation in the future. We are particularly happy that this is taking place under the auspices of the Italian Presidency of the European Union.

For time and space constraints, we have not covered all projects. We have been forced to make a selection and to give more space to some activities that seems to us paradigmatic and that could be inspiring also for future research, especially under SwafS-Horizon 2020. In order to identify these projects we have used, under the Terms or Reference provided by the Commission, the diction "best-practice". As it has often signalled, this wording is highly controversial and many would advise to substitute it with the less judgemental term "good-practice". Besides the wording, we hope that the cases we have pointed out will provide food for thought.

The Local Scientific Committee wishes first of all to thank Riccardo Pozzo, the Director of the Department of Social Sciences and Humanities at the Italian National Research Council. He has been the Mastermind behind the organization of the Conference, including its innovative way to link academic contents to extra-academic activities. Hopefully, the Conference will be an example of how new ideas can be generated in an entertaining social environment.

It is with great pleasure that we look forward to discuss the Rome Declaration on Responsible Research and Innovation, a Declaration that could also seen as a bridge between the understandings and achievements of the past and the challenges of the future.

Our colleagues organizing the programme of the Conference have provided constant feed-back, and we wish to thank Rosaria Conte. Giulia Bonelli and Federica Mattei have also provided help and stimulus. The Conference itself has been co-organized with the Italian Associazione per la Promozione della Ricerca Europea (Association for the Promotion of European Research, APRE). Emanuela Danè have been particularly helpful in organizing the printing and the graphic design of the report.

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Public Engagement

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1. Public Engagement in Science and Technology

The 2009 MASIS Report (European Commission, 2009), one of the main evaluation documents on the European projects on Science in Society, begins recalling the article 27 of the *Universal Declaration of Human Rights*, which reads: 'Everyone has the right freely to participate in the cultural life of the community, to enjoy the arts and to share in scientific advancement and its benefits'. Public Engagement in science and technology refers to the modes and the extent of this sharing.

In the European context, as in the whole world, Public Engagement in research and innovation has acquired increasing importance, as a means through which science and society may interact.. 'In Europe, as elsewhere in the world, considerations about the place of science in society are thus not new. But the intensity with which these issues have been discussed, the prominence that science policy has had on political agendas, and the breadth of reform processes that have been implemented in recent years, are far greater than in the past' (Mejlgaard and Bloch, 2012).

In the framework of policy making, in the last decades it has been more and more recognized that research is only one of the many sources of evidence that needs to be combined with other forms of knowledge coming from several different stakeholders, including citizens. This entails that 'in the work of politically relevant knowledge production [...] citizens play an indispensable role, supplementing the contributions of professional experts' (Jasanoff, 2004). According to Jasanoff, only recently 'ruling institutions have recognized to varying degrees that members of contemporary polities are epistemic actors'. This new form of citizenship has been called 'scientific citizenship', and consists in the active and knowledge-driven participation of citizens to democratic processes, including agenda setting, information gathering, co-creation and evaluation.

In its present context, Public Engagement implies inclusive multi-actor dialogues and exchanges between different stakeholders including researchers, policy makers, industry, civil society organisations, NGO, and citizens. Public Engagement in science and technology is a means to 'co-create the future with citizens and civil society organisations, by bringing on board the widest possible diversity of actors that would not normally interact with each other' (European Commission, 2013a). This definition includes and goes well beyond all those activities traditionally called 'science communication'.

2. Public Engagement in FP6-SaS and FP7-SiS

The FP6 *Science and Society* (FP6-SaS) and FP7 *Science in Society* (FP7-SiS) programmes contributed towards shape Public Engagement in research and innovation, with the aim of building an effective and democratic European knowledge-based society. This process is continuing within the new *Horizon 2020 Science with and for Society* (H2020-SwafS) programme. The Interim Evaluation Report of Science in Society actions recognized that

'arguably the greatest impact of the FP6-SaS and FP7-SiS has been to raise the political importance of science in society [...], raising awareness of the problems and the need for all actors to work together' but also of 'enhancing the understanding of the nature of problems' (Technopolis-Fraunhofer, 2012).

According to the Interim Report, both programmes contributed to the development of new tools and methods of participation, significantly enhancing the engagement of the public, policymakers and businesses in scientific debate. 'The programmes have made advances in establishing new ways to engage, in particular, civil society organisations and public bodies at local and regional levels' (Technopolis-Fraunhofer, 2012). A particular positive role has been recognized for Mobilisation and Mutual Learning (MML) Action Plans, a particular kind of project designed to foster close collaboration between scientists, policymakers and Civil Society Organisations and citizens, in key policy areas. The MML provide an effective model for enhanced integration of stakeholders in European research' (Technopolis-Fraunhofer, 2012).

The FP7-SiS programme acknowledged the need for more participatory involvement of the public via 'two-way communication channels that enable the public and policy-makers to engage with science, and scientists to engage with the public'. The specific FP7-SiS objectives addressed in third action line, entitled 'Science and society communicate', included the need 'to enable the public to engage with scientists', 'to enable closer dialogue between scientists and the media', 'to provide tools for the public to express views on science', 'to provide the wider public with more scientific information'.

However, Public Engagement was also included in other action lines. From an analysis of project abstracts, we have identified more than 40 projects in FP6-SaS and more than 60 projects in FP7-SiS whose main aims include Public Engagement issues (Fig. 1). This assessment did not consider to which degree public engagement was also embedded in other FP programmes, so the above figures are an underestimation of the take-up of public engagement in science.

2.1 Overview of FP6 Science and SocietyProjects

Looking at the FP6-SaS projects, we find a variety of different approaches. A significant number of projects deal with traditional science communication activities. Among these, many are devoted to the implementation of science festivals, science weeks and similar events. Among this kind of projects there are for instance ESCIENTIAL, ESOF, SKY WATCH, WONDERS. Also in this context the EC supported the European Science Open Forum (ESOF), which has led to recurrent bi-annual conferences fostering science in society issues. Other projects organised contests for young people (e.g. EUROBOT), or have contributed to specific events, like VENUS TRANSIT 2004, organised for the passing of the planet Venus in front of the Sun.

Figure 1. Public Engagement in FP6-SaS/FP7-SiS

Note: Some FP6-SaS and FP7-SiS projects which include public engagement issues in their main aims (font dimension indicates the project duration, lighter blue stands for more recent projects. FP6: serif font, FP7: sans serif font.)

Another batch of projects was devoted to the use of media in science communication, as SCIRAB, ESCW, EARTHWAKE and others.

There were also projects that aimed to foster awareness of societally-relevant scientific issues, for instance, related to the environment and sustainability (e.g. SHIELD), or the impact of science and technology on everyday life (e.g. SUPERLIFE, COT-2). Whereas others focused on very specific topics, like WESPA on microelectronics and semiconductor physics, or SWEETS on space weather.

Another approach is the Public Engagement of society intended as the involvement of different actors in the science-society relationship. This topic is not present in the first FP6-SaS calls, but appears later, and is more fully developed in FP7-SiS. An example of a project with this approach is PATH, which claimed in its abstract that 'deliberation of science-based issues and formulation of policy is no longer the exclusive realm of politicians and experts'. Some of the projects that embraced this approach dealt with issues like risk governance (e.g. STARC), citizens and civil society participation (e.g. CIPAST, PSX2), involvement of public institutions at local level (e.g. ESCITY). Whereas others focused on very specific topics like fisheries management (SAFMANS) or addressed to specific target groups like as, patient organisations (CAPOIRA), or NGOs (INRE). Other projects focused on holding deliberative debates (e.g. DECIDE, ECD).

Then there were projects specifically aimed to implement activities with science museums and science centres, like DOTIK, EuEv or Discovery Days. In the more recent calls we explicitly found the topic of science and the art, already anticipated in the HULDA experience and developed in projects like ISWA, STUDIOLAB, CISCI (specific on cinema and science) or DNA-TEST (which involves science theatre).

Finally, there were some projects lying at the boundary between public engagement and other areas including science education (e.g. FW-SCIENCE 2004, ECFUN), ethics (e.g. HEALTHRESEARCHETHICS), and gender (e.g. CEC-WYS, FEMSTART).

2.2 Overview of FP7 Science in Society Projects

In FP7-SiS we find some calls regarding science communication which follow the same scheme of FP6-SaS ones, aiming at maintaining those initiatives considered particularly successful; for example continued support of ESOF and other events like the EUCYS contest.

Many other calls integrate innovative and developing issues, like the notion of scientific citizenship, which were not directly addressed in FP6-SaS. In FP7-SiS we find projects specifically devoted to the relationship between science and politics, like MACOSPOL and MIRRORS, and then a large number of projects that deal with public debate and deliberative processes. At the beginning, this topic appears in the calls only related to very specific scientific questions, like nanotechnologies (which is implemented within projects like NANOPLAT and FRAMINGNANO) or education (implemented in projects like COREFLECT). But some subsequent calls are entirely devoted to the topic of deliberation, public debate on S&T, participatory democracy, without reference to any specific scientific issues. Under these calls we find projects, like CASC, COMSCIENCE, SCICAFE, FUND, PACITA and others. Among these projects, some are focused on the relation with public institutions, like cities (as for instance in the projects PLACES and CREATIVECH). Others are linked to related themes as education (e.g. SIS-CATALYST) or governance issues (e.g. STEPS, CONSIDER). In FP7-SiS calls there is also increased attention to the involvement of stakeholders, implemented in projects like GAP1 and GAP2 or CEECEC (this last with particular focus on Civil Society Organisations).

Another innovative topic of FP7-SiS is the relationship between research institutions, the media and the public. We find projects specifically addressed to scientists in order to improve their science communication skills (e.g. ESCONET) and projects aimed at improving the relationship among scientific community and the media (e.g. RELATE, MYSCIENCE).

Other themes of FP7-SiS resume topics of the previous framework programme, integrating new dimensions. The topic of science and the media is still present but more focused on ICT, and more generally to science-society interactions in the digital era. This approach is implemented in projects like AVSA or EMAPS, in which particular attention is placed on the use of the web for participatory communication between scientists and different publics.

The implementation of projects with museums, science centres and science shops in order to connect the general public to scientific achievements is also continued within FP7-SiS. Examples of such projects are SCICOM, 2WAYS, ACCENT, EUZOOS-XXI, VOICES and PERARES. PERARES addresses science shops and includes a variety of objectives also encompassing participatory democracy issues.

Calls fostering the awareness of societally-relevant scientific issues were continued and expanded in FP7-SiS, as a means to raise public awareness and participation towards tackling societal challenges. We find several projects devoted to such themes, like health (EUROCANCER COMS), food (INPROFOOD), marine environments (MARLISCO, SFS, GAP2), ageing (SIforAGE), energy (R&DIALOGUE), water (BEWATER), pandemics (ASSET), neuro-enhancement (NERRI), sustainable Innovation (CASI). There are also projects which aim to assess the social impact of scientific research (e.g. SIAMPI).

From 2012 we also find projects focused on Responsible Research and Innovation (NERRI and PIER), a new narrative central to H2020-SwafS issues.

A particular highlight of FP7-SiS is VOICES, a pilot launched by the EC and implemented by the ECSITE network

of European Science Museums. The aim of this initiative was to develop and implement a citizen engagement methodology through which the EC could design Horizon 2020 calls for the area of waste research. According to project documentation, one thousand citizens took part in this participatory process, which held focus groups in 27 countries and 23 languages. The outcome led the definition of 5 waste research topics under the Horizon 2020 2014-2015 calls, for an EC contribution of 116 million Euro. This represented the first time that citizen deliberations directly contributed to European research agenda-setting.

3. Public Engagement in the whole FP7

The 2009 MASIS report highlighted that 'a major weakness of FP7-SiS was that science and society issues were embedded in other parts of the Framework Programmes' (European Commission, 2009). However, the 2012 Interim report recognized that considerable progress had been made in increasing 'both the horizontal and vertical integration of FP7-SiS elements in all areas' (Technopolis-Fraunhofer, 2012). The enhancement of the vertical dimension of Science in Society aspects in the whole WP7 arguably represents one of the most important achievements of the FP7.

Public Engagement issues are particularly suited to be developed in a vertical dimension, and it has been noted that 'the majority of the projects supported across the FP6-SaS and FP7-SiS programmes have involved, to a greater or lesser degree, aspects of public engagement and the two-way interaction between scientists and non-scientists' (Technopolis-Fraunhofer, 2012). One of the need that emerged from the feedback of project participants was to 'continue ensuring that good engagement and communication practices are embedded in all parts of the programme' (Technopolis-Fraunhofer, 2012).

Exploring other FP7 programmes, we found several examples of projects centred on Public Engagement. Some of these examples are the projects NANOPINION, funded under FP7-NMP and aiming at information, outreach, and dialogue nanotechnologies; OPEN:EU, funded under FP7-ENVIRONMENT, which aimed to develop a online network of decision-makers, Civil Society Organisations and businesses leaders; EVERYAWARE, funded within FP7-ICT, which aimed to integrate different phases environmental management embedding a strong citizen science dimension.

The Interim Report also contains the data of the questionnaires administered to project coordinators and other stakeholders (Technopolis-Fraunhofer, 2012). It reveals that among the FP7 projects that engaged actors beyond academic communities, 70% 'had engaged with citizens or organised civil society, mostly through the communication, dissemination and use of projects results, but also to a lesser extent in determining and implementing the research' (Technopolis-Fraunhofer, 2012). There is also a 43% of projects which 'involved actors whose role was mainly to organise the dialogue with citizens and civil society (e.g. professional mediators, communication companies, science museums)' (Technopolis-Fraunhofer, 2012). This demonstrates that Public Engagement issues are extending to areas different from those covered by FP6-SaS/FP7-SiS/H2020-SwafS, addressing a need for more inclusive and participatory science. However, the know-how required for this involvement is not necessarily present in a research entity. 'Scientists are increasingly expected to engage in public communication, though they frequently report that they feel inadequately prepared for such activity' (Trench and Miller, 2012). Consequently, a need that seems to be utterly relevant for fostering Public Engagement dimension is the enhancement of the Public Engagement know-how in research infrastructures and amongst researchers. This issue, which began to be addressed via some FP7-SiS calls, will be further developed within H2020-SwafS, as we will see in the next paragraph.

4. The Future of Public Engagement: H2020-SwafS and Perspectives

It has been observed that 'even after several decades of political, academic and broader societal attention, and after a focused research and practical implementation effort under the "Science in society" scheme of the European Commission, the issue of public engagement has in no way become trivial, and there is no homogeneous European model of public engagement with science' (Mejlgaard et al., 2012). At the same time, 'the most appropriate conditions and mechanisms for achieving science in society objectives are not yet fully understood' (Technopolis-Fraunhofer, 2012). However, one clear direction was envisaged as early as 2007: the transformation of Europeans 'From passive consumers to concerned citizens' (European Commission, 2007).

Looking to the FP6-SaS and FP7-SiS projects, a significant room for improvement can be found within the so-called 'dissemination' activities. The Interim Report revealed 'no significant differences' in FP6-SaS and FP7-SiS project-level dissemination activities, consisting basically in events (workshops, conferences, information days), online information, articles, media. Among these activities, only workshops seem to include the interactive, two-ways dimension which has been considered so important. One possibility could be to integrate the Public Engagement dimension within the dissemination activities. This alone however may not lead to the desired impact whereby outcomes of deliberations are effectively fed back into the research and innovation process. Ideally, public engagement should be, in particular, fostered through dedicated (or within) topics calling for transdisciplinary and participatory research and innovation actions, and Mobilisation and Mutual Learning actions. Such topics would then be responsive to mainstreaming RRI as a cross-cutting issue.

This implies further broadening the concept 'science communication', a process that started with the acknowledgement of the necessity of a transition from a 'transmission model' to a 'transaction model' (European Commission, 2012). In the Interim Report, doubts are expressed on the aim of science communication: 'it is not quite clear whether science communication is about ensuring public trust in the science system, about improving the image of science [...], about increasing awareness and understanding so that stakeholders can engage and interact more fully with science, or about increasing the utility of science by connecting it more closely to societal (industrial, policy, public) needs. Experts tell us that the European Commission itself does not seem to be very clear about the aims and objectives of science communication' (Technopolis-Fraunhofer, 2012).

On the one hand, 'a notable common trend is that the efforts and attention paid to science communication in general and communication aimed at young people in particular is on the rise in most of Europe' (European Commission, 2012), on the other hand, the aim of communication is often still seen as 'ensuring the viability of policy options' (European Commission, 2012). If 'the number of actors involved in science communication is increasing, adding to the complexity of the field, but also involving new formats and modes of communication, particularly through web-based media but also large-scale interactive initiatives such as science festivals' (European Commission, 2012), dissemination strategies of FP7-SiS projects still do not have fully integrated an active role of the citizens and stakeholders.

This reflects a societal trend. The 2013 Special Eurobarometer of RRI (Responsible Research and Innovation), Science and Technology reveals that television is still the main source of information about developments in science and technology, with a 65% of preferences, against a mere 35% for the internet (European Commission, 2013c). Notably, television is the less interactive media, while internet may include – but not necessarily – more two-directional options. Moreover, the 2007 ERA Survey showed 'a significant body of opinion that is also concerned to improve and deepen the reciprocal engagement of "science" with "society"' (European Commission, 2007), and the 2013 Eurobarometer showed that on decisions about science and technology the 31% of respondents claimed that 'citizens should only be informed', while a 39% believes that 'citizen should be consulted and their opinion should be considered' and a 12% that 'citizens should participate and have an active role' (Fig. 2).

The integration of Public Engagement aspects in the 'dissemination' activities seems to be particularly necessary regarding the dissemination to specific groups of stakeholders, especially policy makers. 'Policymakers and other stakeholder groups, including relevant national officials, find it difficult to engage with the large volume of work ... there is an evident "gap" in terms of efforts to appraise, aggregate and package the programme's content and results into a digestible form, and to disseminate this information widely to relevant audiences' (Technopolis-

Fraunhofer, 2012). Among the policy makers, European Commission officers do not seem to represent an exception: 'there are problems for the Commission itself to gain a good overview or insight into the results of the FP7-SiS programme and individual projects' (Technopolis-Fraunhofer, 2012).

Regarding these aspects, initial doubts have been expressed on the Horizon 2020 setup emerging from the early documents. 'Experts expressed some concern about the Science in Society element in the next generation of the Framework Programme – Horizon 2020. Both the FP6 and FP7 programming periods have allowed for a mix of bottom-up and top-down approaches to science and society issues, but Horizon 2020 looks more like a top-down programme. Moreover, in the Commission documentation relating to Horizon 2020 , European citizens are predominantly portrayed as users or consumers, whereas their role as active participants in science, or as being engaged and having an interest in science is not emphasised' (Technopolis-Fraunhofer, 2012). The same concern appeared in the FP6 evaluation, in which it was claimed that 'a new bottom-up format (inspired by NEST in FP6) should be introduced to test research directions and original ways of achieving collaboration' (Rietschel and Arnold, 2009).

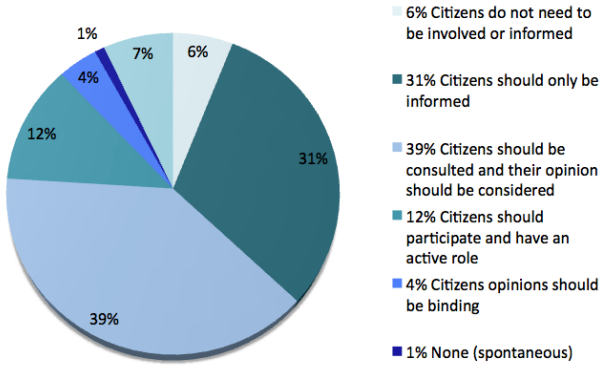

Figure 2. Desired Involvement of Citizens in Science and Technology

Source: data in European Commission 2013c, p. 37, here represented in pie chart. The question was: 'What is the level of involvement citizens should have when it comes to decisions made about science and technology?'

In its final form, the first H2020-SwafS Work Programme seems to take these aspects in serious consideration, through their inclusion in the conception of Responsible Research and Innovation (RRI): 'Citizens interests and values need to be better integrated into science, technology, research and innovation issues, policies and activities. This integration will increase the quality, relevance, social acceptability and sustainability of research and innovation outcomes in various fields of activity from social innovation to nanotechnology. This integration will be made possible by promoting Responsible Research and Innovation, i.e. the engagement of citizens and society in a co-creative research and innovation process' (European Commission, 2013b).

Several topics of this first set of calls address relevant questions on Public Engagement. The topic ISSI.2.2014 aims 'to empower and draw on the collective intelligence of citizens to examine the role of research and innovation via future scenarios and visions of desirable sustainable futures'. This call takes inspiration from the FP7-SiS VOICES project, but is far more ambitious seeing its aim is to provide citizen-inspired ideas for at least three societal challenges of Horizon 2020 . Topic ISSI.5 aims to promote instructional change in research organisations to take-up and build capacity for public engagement in research and innovation. It is also notable the topic ISSI.4.2015, for a knowledge-based decision-making with the involvement of citizens and stakeholders. As said in the previous paragraph, a specific topic (SEAC.2.2014, Responsible Research and Innovation in Higher Education Curricula) answers the need of the integration of Public Engagement issues in the educational programmes for science and engineering studies, contributing to 'shape more responsible and responsive researchers, able to better frame their research in a societal context, necessary for tackling societal challenges more effectively and in a more transdisciplinary manner' (European Commission, 2013b). Other topics are related to Public Engagement in a more traditional way, continuing to develop and improve the trajectory started in FP6-SaS.

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Annex 1 – Main Projects in the Public Engagement Area.

These tables have been completed in cooperation with EC officiers. FP6 and FP7 lists include projects in the Science Communication and Public Engagement areas according to EC internal criteria.

FP6 projects

Project Acronym	Project Title	Coordinator (Name Of The Organization And Country)	Number of partners involved	Start Date	End Date	Duration (Months)	Total Cost (€)	Total Funding (€)	Contract Type**
ANTARCTICSUMMER	An Antarctic Summer	DRY VALLEYS PRODUCTIONS, FRANCE	1	01-01-07	30-06-08	18	100000	100000	SSA
CAPOIRA	Capacity-Building For Patient Organisations To Participate In Research Activities	EUROPEAN ORGANISATION FOR RARE DISEASES, FRANCE	5	01-01-07	30-06-08	18	154581	154581	SSA
CIPAST	Citizen Participation In Science And Technology	CITE DES SCIENCES ET DE L 'INDUSTRIE, FRANCE	12	01-04-05	31-03-08	36	750000	750000	CA
CLIMER	Climate Research On Mediterranean Radio Stations	ISTITUTO NAZIONALE DI GEOFISICA E VULCANOLOGIA, ITALY	6	na	na	na	175920	175920	SSA
COT-2	Composites-On-Tour-2	KATHOLIEKE UNIVERSITEIT LEUVEN, BELGIUM	8	01-03-06	30-11-07	21	308245	308245	SSA
DISCOVERY DAYS	Discovery Days: Advanced Technology Meets Science And Culture. Using Advanced Technological Applications To Improve Visitors Experience In Museums, Science Centres And Archaeological Sites	INTERNATIONAL ENVIRONMENT AND QUALITY SERVICES S.A.	10	01-01-07	31-12-07	12	350000	350000	SSA
DNA-TEST	Dna Traveling Exhibition And Science Theatre	FLANDERS INTERUNIVERSITY INSTITUTE FOR BIOTECHNOLOGY VZW, BELGIUM	3	01-02-07	31-07-08	18	230000	230000	SSA
DOE	Damocles Over Europe	INTERNATIONAL POLAR FOUNDATION, BELGIUM	2	01-11-06	31-10-08	24	190000	190000	SSA
DOTIK	European Training For Young Scientists And Museum Explainers	SCUOLA INTERNAZIONALE SUPERIORE DI STUDI AVANZATI, ITALY	4	01-02-05	31-03-07	26	328200	328200	SSA
E-CASTEX	Promotion And Support Of The Transfer Of Scientific Touring Exhibitions At European Level	ROYAL BELGIAN INSTITUTE OF NATURAL SCIENCES, BELGIUM	5	01-01-07	31-12-08	24	348600	272000	SSA
EARTHWAKE	European Television? A Workshop To Prepare A New Agenda For Science Communication	EUROPEAN ASSOCIATIONF THE PROMOTION OF SCIENCE AND TECHNOLOGY, FRANCE	4	01-01-07	30-11-07	11	64800	64800	SSA
ECD	'Meeting Of Minds. European Citizens' Deliberation On Brain Science'	KING BAUDOUIN FOUNDATION, BELGIUM	12	01-11-04	31-10-06	24	1360352	800000	CA

ESCIENTIAL - I.E.	European Science Festival: Itinerant Exhibitions	ASSOCIAZIONE FESTIVAL DELLA SCIENZA, ITALY	9	01-07-06	30-09-07	15	199500	199500	SSA
ESCITY	Europe Science And The City: Promoting Scientific Culture At Local Level	INSTITUT DE CULTURA DE BARCELONA, SPAIN	6	01-03-06	29-02-08	24	192000	192000	SSA
ESCW	Escw: The European Science Communication Workshops	UNIVERSITY COLLEGE LONDON, UK	18	01-07-05	31-08-08	38	323760	323760	SSA
EUEV	Joint Exhibition On Evolution	STIFTUNG DEUTSCHES HYGIENE-MUSEUM, GERMANY	3	01-07-05	30-06-08	36	357290	299540	SSA
EUROBOT 2006	Eurobot: Robotic Educational Events To Promote A Dissemination Of Science And Technology Among Young People In Europe.	VM GROUP SA, FRANCE	6	02-01-06	01-02-07	13	885667	691749	SSA
EYSCTS	European Young Scientist Contest Television Series	MEDIA AND EDUCATION PRODUCTIONS BV., THE NETHERLANDS	1	01-05-07	31-01-08	9	150000	150000	SSA
FUTURE DECTECTIVES	Co-Production On European Research And Future Studies Targeted At Young People	MONDAY PRODUCTION APS, DENMARK	12	01-09-07	28-02-09	18	250000	250000	SSA
FUTURE ENERGY	Les Energies Du Futur: L'environnement, Prise De Conscience Et Source D'emplois	LOUVRANGES BROADCAST SPRL, BELGIUM	2	19-03-07	18-03-08	12	130000	130000	SSA
FUTURESHOCK	Baltic Popular Science Tv Show "Futureshock"	HANSAMEDIA, LATVIA	3	01-09-07	30-11-08	15	150000	150000	SSA
GENIUS	Television Magazine "Genius"	RTC TELE-LIEGE ASBL, BELGIUM	10	01-01-08	28-02-09	14	200000	200000	SSA
INRE	Involving Ngos In Renewable Energy Research	BLACK SEA REGIONAL ENERGY CENTRE, BULGARIA	4	01-02-07	31-01-08	12	115651	115651	SSA
LERU-KIDS	Leru-Kids-University	RUPRECHT-KARLS-UNIVERSITAET HEIDELBERG, GERMANY	12	01-03-05	28-02-06	12	297600	297600	SSA
LETS!	Let_S Talk About Science	FREIER RUNDFUNK SALZBURG - VEREIN ZUR FOERDERUNG VON FREIEN, LOKALEN RADIO UND FERNSEHPROJEKTEN – RADIOFABRIK, AUSTRIA	4	01-01-07	29-02-08	14	130000	130000	SSA
MESSENGER	Media, Science And Society: Governance And Engagement In Europe	SOCIAL ISSUES RESEARCH CENTRE, UK	2	15-02-05	14-02-06	12	267480	267480	SSA
MEYPS SC2	European Mobility Of Young People And Scientists In Scientific Culture Context	UNIVERSITE DES SCIENCES ET TECHNOLOGIES DE LILLE, FRANCE	3	01-01-07	31-03-09	27	200000	200000	SSA

PARCEL	Participatory Communication Activities On E-Learning	WISENSCHAFTSLADEN WIEN, AUSTRIA	5	01-06-05	30-11-07	30	175983	175983	SSA
PATH	Participatory Approaches In Science And Technology	THE MACAULAY LAND USE RESEARCH INSTITUTE, UK	8	01-04-04	31-12-06	33	200000	200000	CA
PSX2	Participatory Science And Scientific Participation: The Role Of Civil Society Organisations In Decision Making About Novel Developments In Biotechnologies	CONSIGLIO DEI DIRITTI GENETICI ONLUS, ITALY	8	01-02-07	30-11-08	22	434332	434332	CA
RISK-BRIDGE	Building Robust, Integrative Interdisciplinary, Governance Models For Emerging And Existing Risks	NEDERLANDSE ORGANISATIE VOOR TOEGEPAST NA-TUURWETENSCHAPPE-LIJK ONDERZOEK, THE NETHERLANDS	6	01-07-06	31-03-09	33	776105	776105	CA
RISK-NETWORK	Risk Communication Network	LUDWIG-MAXIMILIANS-UNIVERSITAET MUENCHEN, GERMANY	8	01-06-05	30-11-07	30	500000	500000	SSA
SAFMAMS	Scientific Advice For Fisheries Management At Multiple Scales	INSTITUTE FOR FISHERIES MANAGEMENT AND COASTAL COMMUNITY DEVELOPMENT, DENMARK	7	15-04-05	14-04-08	36	690120	690120	SSA
SCIRAN	Creating A Science And Research Radio Programme Network For Internet And Air Broadcast	EUTEMA TECHNOLOGY MANAGEMENT GMBH, AUSTRIA	4	na	na	na	198292	198292	SSA
SKOOL	Skool	KAOS FILMS, BELGIUM	4	na	na	na	954922	655000	SSA
SKY WATCH	Sky Watch: Introducing European Youth In The World Of Scientific Research Through Interactive Utilisation Of A Global Network Of Robotic Telescopes	INTERNATIONAL ENVIRONMENT AND QUALITY SERVICES S.A., GREECE	8	01-02-05	31-01-06	12	495040	495040	SSA
STACS	Science, Technology And Civil Society - Civil Society Organisations, Actors In The European System Of Research And Innovation	CYPRUS INTERNATIONAL INSTITUTE FOR THE ENVIRONMENT AND PUBLIC HEALTH IN ASSOCIATION WITH HARVARD SCHOOL OF PUBLIC HEALTH EPE, CYPRUS	1	01-03-07	30-04-09	26	415847	389177	SSA
STARC	Stakeholders In Risk Communications	ELECTRICITE DE FRANCE S.A., FRANCE	6	01-06-05	30-11-06	18	337491	337491	CA
SVALBARD	Students Of The Arctic	MOSTRA S.A., BELGIUM	2	na	na	na	359534	359534	SSA
SWEETS	Space Weather And Europe And Education Tool With The Sun	ERNST-MORITZ-ARNDT-UNIVERSITY OF GREIFSWALD, GERMANY	17	01-01-07	31-12-07	12	500185	500185	SSA
TRAMS	Training And Mentoring Of Science Shops	UNIVERSITEIT UTRECHT, THE NETHERLANDS	18	01-05-05	30-04-08	36	449250	449250	CA
TRUSTNET	The Making Of Inclusive Risk Governance: Trustnet-In-Action	MUTADIS CONSULTANTS SARL, FRANCE	16	01-01-04	31-12-06	36	799623	799623	CA

VIA	Véhicule Innovants D'avenir	UNIVERSITÉ NANCY 2, FRANCE	8	01-02-07	31-12-09	35	150000	150000	SSA
WONDERS	Wonders - Welcome To Observations, News And Demonstrations Of European Research And Science	EUROPEAN SCIENCE EVENTS ASSOCIATION, AUSTRIA	3	01-01-06	28-02-07	14	799982	799982	CA
WONDERS07	Welcome To Observations, News And Demonstrations Of European Research And Science 2007	EUROPEAN SCIENCE EVENTS ASSOCIATION, AUSTRIA	3	01-01-07	31-12-07	12	450000	450000	CA
WYP2005 EUROPE	World Year Of Physics 2005: Activities In Europe	EUROPEAN PHYSICAL SOCIETY, FRANCE	24	01-01-05	31-01-06	13	3390864	2083300	SSA
XJENZA-TV	Science Popularisation Tv Bringing Those The Knoweldge Society To Those Not Yet Participating.	UNIVERSITY OF MALTA, MALTA	4	01-04-07	30-06-09	27	425000	340000	SSA

Source: CORDIS Open Data - provisional list to be refined for the Stocktaking Final Report

***SSA - Specific Support Action; CA- Coordination action*

FP7 projects

Project Acronym	Project Title	Coordinator (Name Of The Organization And Country)	Number of partners involved	Start Date	End Date	Duration (Months)	Total Cost (€)	Total Funding (€)	Contract Type**
2WAYS	Two Ways For Communicating European Research About Life Sciences With Science Festivals & Science Centres/ Museums, Science Parliaments Impact Survey	EUROPEAN SCIENCE EVENTS ASSOCIATION, AUSTRIA	7	01-01-09	31-12-10	24	992076	966600	CSA-SA
4SEAS	Synergies Between Science And Society For A Shared Approach To European Seas	ISTITUZIONE MUSEI DEL MARE E DELLA NAVIGAZIONE, ITALY	7	01-03-08	28-02-10	24	512894	439085	CSA-CA
ACCENT	Action On Climate Change Through Engagement, Networks And Tools	FONDAZIONE IDIS-CITTÀ DELLA SCIENZA, ITALY	15	01-04-09	31-03-11	24	1348965	1017880	CSA-CA
ASSET	Action Plan On Sis Related Issues In Epidemics And Total Pandemics*	VITAMIB SAS, FRANCE	15	01-01-14	31-12-17	48	4496454	3939880	CSA-SA
AVSA	Audio Visual Science Audiences (Avsa). A Comparative Study	FREIE UNIVERSITAET BERLIN, GERMANY	5	01-04-08	31-03-10	24	638576	499831	CP-FP

BEWATER	Bewater - Making Society An Active Participant In Water Adaptation To Global Change*	CENTRO DE INVESTIGACION ECOLOGICA Y APLICACIONES FORESTALES, SPAIN	12	01-10-13	31-03-17	42	3588713	2934724	CSA-SA
CASC	Cities And Science Communication: Innovative Approaches To Engaging The Public	BIRMINGHAM CITY COUNCIL, UK	20	01-05-09	28-02-11	22	1119582	870980	CSA-CA
CASI	Public Participation In Developing A Common Framework For Assessment And Management Of Sustainable Innovation*	APPLIED RESEARCH AND COMMUNICATIONS FUND, BULGARIA	19	01-01-14	30-06-17	42	4473404	3897381	CSA-SA
COMSCIENCE	Comscience Network: Providing Added Value To Eu Research Dissemination Efforts At Regional Level	LUDWIG-MAXIMILIANS-UNIVERSITAET MUENCHEN, GERMANY	8	01-04-09	30-06-12	39	1032150	794720	CSA-CA
CONSIDER	Civil Society Organisaions In Designing Research Governance*	DE MONTFORT UNIVERSITY, UK	8	01-02-12	31-01-15	36	1849467	1499381	CP-FP
EJOLT	Environmental Justice Organizations, Liabilities And Trade*	UNIVERSITAT AUTONOMA DE BARCELONA, SPAIN	23	15-03-11	14-03-15	48	4078038	3651921	CSA-SA
EMAPS	Esafety Digital Maps Public Private Partnership Support Action	FONDATION NATIONALE DES SCIENCES POLITIQUES, FRANCE	6	01-09-11	28-02-13	18	452861	399000	CP
ENGAGE2020	Engaging Society In Horizon 2020*	FONDEN TEKNOLOGIRÅDET, DENMARK	6	01-09-13	30-11-15	27	1224310	998123	CP-FP
ESCONET	Esconet Trainers	UNIVERSITY COLLEGE LONDON, UK	1	01-01-09	31-07-11	31	609778	543827	CSA-SA
ESOF2010	Euroscience Open Forum 2010	ASSOCIAZIONE TORINO PER ESOF 2010 - TOPESOF, ITALY	1	01-02-10	31-12-10	11	557467	300000	CSA-SA
ESOF2012	Euroscience Open Forum 2012	FORFAS, IRELAND	1	02-02-12	01-12-12	10	1099200	599000	CSA-SA
EUCYS 2008	The European Union Contest For Young Scientists 2008	UNGE FORSKERE APS, DENMARK	1	01-01-08	30-06-09	18	1985437	600000	CSA-SA
EUCYS 2012	European Union Contest For Young Scientists 2012	MLADI VEDCI SLOVENSKA, SLOVAKIA	1	10-01-12	09-01-13	12	850400	600000	CSA-SA
EUCYS 2013	European Union Contest For Young Scientists 2013	AKADEMIE VED CESKE REPUBLIKY, CZECH REPUBLIC	1	01-02-13	31-01-14	12	845200	600000	CSA-SA
EUCYS2009	European Union Contest For Young Scientists 2009	COMMISSARIAT A L'ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES, FRANCE	1	01-11-08	30-04-10	18	1067403	600000	CSA-SA
EUCYS2010	European Contest For Young Scientists	FUNDACAO DA JUVENTUDE, PORTUGAL	1	03-03-10	02-03-11	12	1047256	600000	CSA-SA
EUCYS2011	European Union Contest For Young Scientists 2011	TEKNIIKAN AKATEEMISET RY, FINLAND	1	19-11-10	18-05-12	18	944000	600000	CSA-SA

EUZOOS-XXI	Eu Zoos And Science In The 21st Century: Engaging The Public In Nature Conservation	NORDECONSULT SWEDEN AB, SWEDEN	7	01-09-09	31-08-12	36	862134	758178	CSA-CA
FUND	Facilitators' Units Network For Debates	ASSOCIATION EUROPEENNE DES EXPOSITIONS SCIENTIFIQUES, TECHNIQUES ET INDUSTRIELLES, BELGIUM	3	01-03-09	28-02-11	24	317600	295110	CSA-SA
GAP2	Bridging The Gap Between Science, Stakeholders And Policy Makers Phase 2:Integration Of Evidence-Based Knowledge And Its Application To Science And Management Of Fisheries And The Marine Environmen*	THE SECRETARY OF STATE FOR ENVIRONMENT, FOOD AND RURAL AFFAIRS, UK	39	01-04-11	31-03-15	48	7483566	5913773	CSA-SA
HULDA	Hulda, The European Arts And Sciences Sailing Festival	ILHAN KOMAN KULTUR VE SANAT VAKFI, TURKEY	14	01-05-08	31-12-10	32	1011619	800000	CSA-CA
INPROFOOD	Towards Inclusive Research Programming For Sustainable Food Innovations	UNIVERSITAET HOHENHEIM, GERMANY	18	01-11-11	31-10-14	36	4553171	3893991	CSA-SA
ISWA	Immersion In The Science Worlds Through Arts	UNIVERSITÀ POLITECNICA DELLE MARCHE, ITALY	16	01-03-11	28-12-13	24	1225522	1103791	CSA-SA
MAPPING	Managing Alternatives For Privacy, Property And Internet Governance*	RIJISKUNIVERSITEIT GRONIGEN, THE NETHERLANDS	13	01-03-14	28-02-18	48	4642522	3995765	CSA-SA
MARLISCO	Marine Litter In Europe Seas: Social Awareness And Co-Responsability*	PROVINCIA DI TERAMO, ITALY	20	01-06-12	31-05-15	36	4544747	4119358	CSA-SA
MY SCIENCE	My Science European Program For Young Journalists	ACCADEMIA EUROPEA PER LA RICERCA APPLICATA ED IL PERFEZIONAMENTO PROFESSIONALE BOLZANO (ACCADEMIA EUROPEA BOLZANO), ITALY	3	01-01-09	30-06-10	18	279779	252612	CSA-SA
NERRI	Neuro-Enhancement: Responsible Research And Innovation*	CIENCIA VIVA, PORTUGAL	17	01-03-13	29-02-16	36	3783868	3312430	CSA-SA
PACITA	Parliaments And Civil Society In Technology Assessment*	FONDEN TEKNOLOGIRÅDET, DENMARK	16	01-04-11	31-03-15	48	5141402	4437730	CSA-SA
PE2020	Public Engagement Innovations For Horizon 2020*	KULUTTAJATUTKIMUSKESKUS, FINLAND	5	01-02-14	31-01-17	36	1229660	999341	CP-FP
PERARES	Public Engagement With Research And Research Engagement With Society	RIJISKUNIVERSITEIT GRONIGEN, THE NETHERLANDS	28	01-05-10	31-10-14	54	3085511	2728041	CSA-SA

PLACES	Platform Of Local Authorities And Cities Engaged In Science	ASSOCIATION EUROPEENNE DES EXPOSITIONS SCIENTIFIQUES, TECHNIQUES ET INDUSTRIELLES, BELGIUM	9	01-06-10	31-05-14	48	5916108	5190000	CSA-SA
R&DIALOGUE	Research And Civil Society Dialogue Towards A Low-Carbon Society*	TRIARII BV, THE NETHERLANDS	15	01-06-12	31-05-15	36	4482268	4131441	CSA-SA
RELATE	Research Labs For Teaching Journalists	MINERVA CONSULTING & COMMUNICATION, BELGIUM	5	01-02-09	31-01-11	24	345982	312709	CSA-SA
ROBOLAW	Regulating Emerging Robotic Technologies In Europe: Robotics Facing Law And Ethics	SCUOLA SUPERIORE DI STUDI UNIVERSITARI E PERFEZIONAMENTO SANT'ANNA, ITALY	5	01-03-12	31-05-14	26	1908342	1497966	CSA-SA
SATORI	Stakeholders Acting Together On The Ethical Impact Assessment Of Research And Innovation	UNIVERSITEIT TWENTE, THE NETHERLANDS	16	01-01-14	30-09-17	45	4723129	3662800	CSA-SA
SCICAFE	Scicafe: The Science Cafes Network	IKNOWHOW INFORMATICS, GREECE	14	01-09-09	31-08-12	36	916704	798862	CSA-CA
SCICOM	European Network Of Science Centres In Communicating Energy-Related Topics	WELIOS BETRIEBS GMBH, AUSTRIA	11	01-04-08	31-07-11	40	1000927	894609	CSA-CA
SEISMIC	Societal Engagement In Science, Mutual Learning In Cities*	AUSTRIAN INSTITUTE OF TECHNOLOGY GMBH, AUSTRIA	13	29-10-13	28-10-16	36	3358158	2995118	CSA-SA
SFS	Sea For Society*	SOCIETE D'EXPLOITATIO DU CENTRE NATIONAL DE LA MER, FRANCE	20	01-06-12	30-11-15	42	4893285	4259077	CSA-SA
SIforAGE	Social Innovation On Active And Healthy Ageing For Sustainable Economic Growth*	UNIVERSITAT DE BARCELONA, SPAIN	19	01-11-12	31-10-16	48	4093588	3484788	CSA-SA
SISCATALYST	Sis Catalyst: Children As Change Agents For The Future Of Science In Society*	THE UNIVERSITY OF LIVERPOOL, UK	19	01-01-11	31-12-14	48	4561513	4090120	CSA-SA
STUDIOLAB	Studiolab - A New European Platform For Creative Interactions Between Art And Science	THE PROVOST FELLOWS & SCHOLARS OF THE COLLEGE OF THE HOLY AND UNDIVIDED TRINITY OF QUEEN ELIZABETH NEAR DUBLIN, IRELAND	14	01-07-11	30-06-14	36	1652634	1496348	CSA-SA
SYN-ENERGENE	Synthetic Biology – Engaging With New And Emerging Science And Technology In Responsible Governance Of The Science And Society Relationship*	KARLSRUHER INSTITUT FUR TECHNOLOGIE, GERMANY	28	01-07-13	30-06-17	38	4590081	3960810	CSA-SA
VOICES	Voices	ASSOCIATION EUROPEENNE DES EXPOSITIONS SCIENTIFIQUES, TECHNIQUES ET INDUSTRIELLES, BELGIUM	1	16-01-13	15-07-14	18	1629969	1496624	CSA-SA

Source: CORDIS Open Data - provisional list to be refined for the Stocktaking Final Report

** Project under execution*

*** CSA-SA: Support actions ; CSA-CA: Coordination (or networking) actions; CP: Collaborative project (generic); CP-FP: Small or medium-scale focused research project*

Gender Equality

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1. EU Strategy on Gender Equality

Equality between women and men is one of the fundamental principles of Community law. The European Union's objectives on gender equality are to ensure equal opportunities and equal treatment for women and men, and to combat any form of discrimination on the grounds of gender. With the entry into force of the Treaty of Amsterdam in 1999, the promotion of equality between men and women throughout the European Community became one of the essential tasks of the EU. This principle was reinforced by the Treaty of Lisbon (2007/2009) that in the paragraphs on values and objectives preceding the Treaty, made explicit reference to equality between women and men and to the furtherance of such by the EU. The promotion of equality between women and men was also listed among the tasks of the Union, together with the obligation to eliminate inequalities and to promote equality between men and women in all the Union's activities. Thus, the Lisbon Treaty clearly underlines the obligation of gender mainstreaming for the Union.

The European Commission started discussing the issue of women in science over 20 years ago. It has been a long path since then and remarkable progress has been done on the ground of gender equality in science. Despite progress achieved, gender inequalities in science tend to persist. In 2010, while 59 per cent of EU graduate students and 46 per cent of EU PhD graduates were female, only 33 per cent of active researchers and 20 per cent of full professors were women (European Commission, She Figures 2012).

Faced with this unacceptable and unaffordable waste of human resources in research and technological development, the European Commission has made considerable efforts to promote a more systematic participation of women in every sector and aspect of scientific activities and research management: project activities, presence of women in advisory boards and evaluation committees, career advancements, creation of networks, setting targets of women, just to mention some of them.

No doubt that over the years the European Commission has been a pioneer in implementing gender mainstreaming in science. In order to do so, a number of Expert Groups were charged of deepening various topics linked to women in science, and received support from the European Commission. The results of the debate within the Expert Groups have been collected in various reports and discussed in numerous workshops and conferences. Among others, we remember the ENWISE report (2003), the Gender and Excellence in the Making (2004), the WIRDEM report (2008), the Benchmarking report (2008) and last but not least the ETAN report (2000). Their conclusions and recommendations contributed to enrich the knowledge base on women scientists' situation as well as to identify and review positive actions and gender equality measures at institutional and national level that may help Commission in setting the political agenda.

In the Sixth Framework Programme (FP6), a specific budget for funding projects focusing on women in science was made available within the Science and Society sub-programme of the "Structuring the ERA" specific programme. This dedicated budget was maintained and increased in the Seventh Framework Programme (FP7). Over the years the European Commission has invested on "Women in science" almost 20 million EUR in FP6, and almost 40 million EUR in FP7. A timeline of relevant initiatives undertaken by European Commission in the field gender equality and gender mainstreaming is presented and commented below.

1.1 The ETAN Report

In 1998, the Directorate General for Research of the European Commission set up the expert group "European Technology Assessment Network (ETAN)", in order to explore the issue of women and science in the EU and to make recommendations for change. The ETAN group produced a report of paramount importance, in promoting specific activities aimed at increasing the awareness on the under-representation and under-promotion of women in research sector and finalizing the European Commission agenda on gender equality in research.

The ETAN Report identified three major strategic objectives to be fulfilled in order to promote female scientists. These strategic objectives were the following:

- Raising awareness on the situation of women in science
- Empowering women in science, engineering and technology
- Mainstreaming gender in all other policies, specifically research.

To achieve these recommendations, under FP6, DG Research launched a series of activities, namely: funding research projects, convening Experts' Groups and promoting gender statistics collection.

1.2 The Helsinki Group on Gender in R&I

In November 1999 the advisory group called "the Helsinki Group[1] on women in science" was established with the tasks of monitoring the implementation of the "gender priority" (i.e. gender equality and gender mainstreaming in research). Over the years, the mandate of the Helsinki Group has been enlarged and reinforced (European Commission 2010). Currently the Helsinki Group provides an important forum for dialogue about national policies and for sharing and comparing experiences. The members of the Helsinki Group are representatives of Member States and Associated Countries.

1.3 Facts and Figures: the She Figures.

Sex-disaggregated statistics are crucial to monitor the participation of women and men at different seniority levels, sectors and scientific fields in European Research. In 1999 the information need in terms of primary statistics in European research, was identified. At that time, no systematic or centrally co-ordinated collection of sex-disaggregated data on R&D staff existed at European level. A programme of statistical work was therefore initiated and the group of Statistical Correspondents was created as a subgroup of the Helsinki Group on Women and Science in 2001. This activity has stimulated a number of publications, including the *She Figures,* which contains the widest collection of European data on women and science ever produced. The first issue of *She Figures* was published in 2003. Since then, *She Figures* is issued every 3 years, presenting data and indicators on the situation of women in science. The *She Figures 2015* is now under preparation.

1.4 Networking

A relevant activity supported by the European Commission was networking. In July 1999 the representatives of networks of women scientists and organisations - committed to the improvement of the gender balance in research policy- met in Brussels (see Declaration of Networks Active in Europe 1999). The Networks recognised the rationale of the networking of women scientists in order to:

1 The advisory Group is known as *Helsinki Group* because they met for the first time in Helsinki

- support, enhance and empower members in their careers;
- inform, encourage and motivate young girls to choose scientific subjects;
- make scientific careers more attractive;
- provide a database of role models and mentors for individuals and organisations that require them;
- take part in decision-making processes to contribute to the shaping of scientific institutions and their culture;
- lobby and take part in policy processes in order to improve the gender balance in research and research policy as well as the position of women in science and science policy.

The Networks recommended: "the creation of a *European network of networks* on women and science that should regroup existing networks of women scientists and organisations committed to the improvement of the gender balance in research policy from the European Union and from Eastern and Central Europe".

In 2005 the European Platform of Women Scientists (EPWS) was funded. The EPWS has been economically supported by the European Commission until 2009 and is now working on a voluntary basis. In 2006 BASNET, the Baltic States Network "Women in Sciences and High Technology" was also funded by EC in order to create the monitoring and information systems on Women in Sciences and High-Technology and to concentrate the interdisciplinary efforts on formulation of the common Baltic States science strategy. BASNET was supported by the European Commission until the end of 2007.

Recently, in the field of networking, COST -the intergovernmental framework for European Cooperation in Science and Technology - launched a new initiative (genderSTE) that is intended to advance the state of the art in knowledge and policy implementation on gender, science, technology and engineering through creating a network of policy-makers and experts on gender, science and technology. It will particularly enhance the implementation of gender-focused policy measures for structural change in science and technology institutions and integration of sex and gender dimensions in the content of science and technology.

Finally, in 2013 the European Commission has funded the project "GenPORT: An internet portal for sharing knowledge and inspiring collaborative action on gender and science". The portal will be active in 2016 with the aim of creating an internet-based community of practice on gender equality in science, technology and innovation.

1.5 Action Plan on "Women and Science"

In 2001 an Action Plan on Women and science was launched which set out a strategy to promote research by, for and about women, in co-operation with Member States and other key actors. The rationale for the adoption of the Action Plan was the following: "If society as a whole is to better understand and accept the developments in science and technology, specific measures must be taken to address both the under-representation of women in science, and the lack of attention paid to gender differences within research."

The European Commission launched the strategy of "research by, for, and on women" with the final goal of providing a solid basis for the promotion of gender equality within the European Research Area.

Research "by" women means the promotion of women both as research workers and within the consultation and implementation processes of the Framework Programmes. This includes ensuring that women are informed about the schemes and programmes intended to increase their participation, and to promote equal opportunities between women and men. Research "for" women implies that gender dimension needs to be taken into account when compiling and implementing work programmes to ensure that research meets the needs of all citizens, both men and women. Research "on" women is concerned mainly with supporting gender-relevant research and

contributing to enhance the understanding of the gender question itself (European Commission 2001).

A Gender Action Plan (GAP) outlining how gender dimension feature in actual research content was compulsory for all the so-called integrated projects and networks of excellence in FP6. The GAP should include information about how the gender dimension will be integrated in the research content. It could also include the use of gender awareness groups to encourage networking and mentoring activities. Too often, however, the quality of GAP was not decisive for actual funding. The GAP was eliminated in FP7.

1.6 Interim Report of the FP7 Evaluation

Despite the wide range of initiatives to support women scientists slow progress has been made towards real gender equality in science. In the Interim Report of the FP7 evaluation, the authors highlighted that "The goal of boosting female participation has made some progress, but the glass ceiling alluded to in the final evaluation of FP6 still seems to be intact .... the goal of 40 per cent participation is some way from being met. Behind the data on participation rates, lies the fact that women comprise only some 30 per cent of the research base in the Member States. This means that the target will be very difficult to reach and highlights the need for initiatives at Member State level to increase female participation in research. Women are also under-represented in certain disciplines and at the most senior levels"[2].

Following the recommendations of the Expert Group of the Interim FP7 Evaluation, the European Commission accepted the challenge of taking a leading role in increasing the participation of women in FP7 and launching "... new analyses with the support of Member States and research institutions to identify, by the end of 2011, the cultural and situational factors which help shape female researches' participation, as well as measures to overcome these" (European Commission 2011a).

1.7 A New Strategy: Shifting Towards "Fixing the Institutions"

A new strategy was adopted for FP7. The new focus for activities would be on research institutions and organisations where women scientists work. "Fixing the administrations" (Schiebinger 2007), i.e. analysing the way universities and research organisations are managed from a gender point of view, became the new objective. This is called "Structural Change" and it is focussed on modernising the organisational culture of academic administration of universities, research institutions and funding bodies, in order to let them become more gender-aware and ready to remove obstacles to women's professional careers.

This change in strategy had a clear impact in the objectives indicated in the Calls for Proposals, concerning funding projects, conferences and networks, and in the organisational structure of DG Research and Innovation.

1.8 Gender as a Cross-Cutting Issue in H2020

In view of the new Framework Programme Horizon 2020 (H2020), the European Commission noted that, "in spite of national and EU-level strategies on gender equality, European research still suffers from a considerable loss and inefficient use of highly skilled women. The annual increase in female researchers is less than half the annual number of female PhD graduates and too few women are in leadership positions or involved in decision-making" (European Commission 2012).

Therefore, the European Commission has taken the commitment to end the waste of female talents and to "foster gender equality and the integration of a gender dimension in Horizon 2020 programmes and projects from inception, through implementation to evaluation, including through the use of incentives." The Commission

2 http://ec.europa.eu/research/evaluations/pdf/archive

has also renewed its commitment to ensure 40 per cent of the under-represented sex in all its expert groups, panels and committees and will apply this particularly under Horizon 2020.

In the Framework Programme Horizon 2020, gender is "a cross-cutting issue", meaning that it is "mainstreamed in each of the different parts of the Work Programme, ensuring a more integrated approach". In addition, "The gender dimension is explicitly integrated into several topics across all the sections of the Work Programme. An in-depth understanding of men and women's needs, behaviours and attitudes contributes to the scientific quality and societal relevance of produced knowledge, technologies and innovations. It also contributes to the production of goods and services better suited to potential markets" (European Commission 2013). It is early to evaluate the impact of this position on actual projects, funding and women promotion. We do hope to see real and remarkable progress in gender equality in science under H2020.

In the table below the major steps undertaken so far (Table 1).

Table 1 - EU relevant steps in the field of women in science

1999	Commission Communication on Women and Science is published
1999	Council Resolution on Women and Science is adopted
1999	Helsinki Group is established
2000	ETAN-European Technology Assessment Network Report is published
2002	Report on National Policies on Women and Science in Europe by Helsinki Group is published
2003	WIR-Women in Industrial Research Report on Women in Industrial research is published
2003	The first issue of the report SHE FIGURES is published
2004	ENWISE-Enlarge Women in Science to East Report Waste of talents: turning private struggle into public issue
2004	European Commission report on Gender and excellence in the making is published
2005	EPWS - European Platform on Women in Science is established
2008	WIRDEM-Women in Research Decision Making Report Mapping the Maze
2008	European Commission report on Benchmarking Policy Measure for Gender Equality in Science is published
2009	Commission report on The Gender Challenge in Research funding: assessing the European national scenes is published
2010	Stocktaking 10 years of "Women in Science" policy by the European Commission 1999-2009 is published
2011	European Commission Communication on Response to the Report of the Expert Group on the Interim Evaluation of the Seventh Framework Programme is issued
2012	European Commission Report on Structural Change: Enhancing Excellence, gender equality and efficiency in research and innovation is issued
2012	The fourth issue of the report SHE FIGURES is published
2013	European Commission Report on Gendered innovations: how gender analysis contributes to research is issued
2014	Report Gender Equality Policies in Public Research is issued

2. A "Snapshot" of Research Projects dealing with Gender in Science

2.1. The Activities Carried out Under FP6

In FP6-Science and Society programme, 33 research projects were funded under the "Women and Science" programme, most of them were dealing with raising awareness on women's participation in science (i.e. through conferences, and reports) as well as establishing concrete structures (i.e. databases, centres, platforms) that could provide the basis for long term strategies and measures to promote women's participation in research. The primary target audience were women scientists themselves, but in order to address the gender dimension of the whole research system, the general public, research communities, media and the private sector were also included to a lesser extent (European Commission 2010).

The Calls for proposals and the consequent funded projects disentangled the raising awareness objective in

various ways. The focus was mainly on mainstreaming gender equality in scientific institutions through in-depth analysis of the career paths of women and men. Attention was paid to the so-called "working culture" and the existing practices in recruitment and employment of scientists in view of highlighting areas of potential gender bias.

Innovative pilot studies and surveys, designed to complement and enhance existing knowledge, and to open up new perspectives for further in-depth work in the field of women in science were funded. These data collections included the exploiting of new data sources, the undertaking of feasibility studies, and the proposal of new methodologies.

A number of projects have developed mentoring schemes. Attention was also paid to role models in science, through a specific call concerning "Ambassadors for Women and Science", looking at establishing policies favourable to female researchers.

Under FP6-SiS programme women scientists working in the private sector, and particularly in industrial research, gained attention and interest by the Commission (European Commission 2003). The scarce presence of women in industrial research was studied by specific research projects, discussed in public conferences, and recommendations for improvement were posed to the relevant stakeholders.

Following the European Commission strategy on gender equality, the Calls for proposals and the funded research projects tackled the issue of women empowerment and the promotion of the participation of women in science decision-making and science policy definition. The aim was to stimulate mechanisms for involving women scientists more actively in research management and policy definition at national and European levels. Practical tools for mainstreaming and monitoring gender equality were developed and discussed.

Media awareness on gender stereotypes and women in science visibility on TV were also considered, in order to fight stereotypes and present female role models in science, engineering and technology that could encourage young women to embark on scientific careers.

The promotion of gender equality in science was also dealt with by developing gender budgeting instruments in science. The main focus of gender budgeting is to discuss the effects of public budgets with respect to equal opportunities for women and men and the transfer of gender mainstreaming to budget policies and to the process of controlling budgets. A research project was funded under FP6-SiS programme with the final aim of developing operational instruments for defining a gender sensitive budgeting process and gender equality auditing.

All together the initiatives taken under FP6-SiS programme concerning women in science covered a vast area of knowledge. The Calls for proposals and the funded projects, networks and conferences seem to be driven by the willingness to shed as much light as possible on the issue of women in science, that was a relatively little known area, and to analyse those sectors that are relevant for the EU policy but scarcely investigated from a gender point of view. We found studies on women in construction sector, agriculture, life sciences, information technologies, engineering, women as patent originators, just to make some examples. The common feature resulting from all these studies was the scarcity of women at any level of the career ladder and the need of positive action programmes and equal opportunities policies. The best practices that were identified could not easily be transferred from one sector to another.

The evaluation report carried out at the end of the Sixth Framework Programme highlighted that only 16-17 per cent of the scientific coordinators and scientists in charge of FP6 funded projects were women, a percentage that falls well below the 40 per cent target. SiS-Science and Society was the only Programme were the target was reached and female researchers make up more than 40 per cent of coordinators and scientists in charge (41 per cent) (European Commission 2008). In Women in Science area, the overwhelming majority of coordinators and scientists in charge were women.

2.2. The Activities Carried out Under FP7

Under FP7-Science in Society programme 25 research projects dealing with "Gender in science" were funded (3 research projects started at the beginning of 2014). The Calls for proposals showed a clear change in the attention and interest of the European Commission towards gender diversity management and structural change in research organisations as a consequence of the change in the European Commission strategy towards women in science.

The funded projects aimed to identify and analyse the strategies and commitments taken by public research organisations in order to foster change, in particular in terms of increasing the participation of women at the highest levels of decision-making and career ladder, as well as in the methods used for recruitment and retention of research. When applying for projects, universities and research bodies were expected to cooperate on common actions in order to increase the participation and career advancements of women researchers. Projects dealing with implementing best practices on gender balance in research and higher education institutions were funded. Actions were taken to involve top decision-makers (rectors' associations, ministries, networks of research associations, etc) in order to obtain their commitment to improve the current situation on gender balance in research positions.

In the Calls for proposals special attention was given to the evaluation of research systems and to the concept of excellence, in order to reinforce the role of women in scientific research, and to enhance the gender dimension of research.

The image of researchers and the stereotypes affecting women in science were also tackled with. A project dealing with science centres and museums on women and science was funded, whose aim was to analyse how much stereotypes and outdated traditions influence the perceptions of women and men in research.

In the framework of international cooperation, the Commission launched a Call for proposal enhancing research cooperation on women in science between the European Union and the Mediterranean Countries. One project was funded with the aim to better understand the situation of women in science in Algeria, Egypt, Jordan, Lebanon, Libya, Morocco, Palestinian-administered areas, Syrian Arab Republic, Tunisia, taking into account cultural diversities and traditions. Projects dealing with databases construction and internet portals implementation were also funded in order to make accessible, timely, value-added the information collected so-far in the field of women in science and to enhance the potential for its exploitation. Among others, we note Euraxess Portal that is a web-based information tool to support the recruitment and mobility of women researchers across Europe. Created in 2008, the portal allows users to contact a network of more than 200 centres located in 35 European countries.

In comparison to FP6, the projects funded under FP7 were less numerous, with more money invested per project, and more focussed on the main strategic objective of the European Commission i.e. structural change. The evaluation of FP7 is not yet finalised. Following the recommendations posed by relevant influential bodies and national governments, in Horizon 2020 gender equality is a cross-cutting issue and will be implemented across and within the priorities of the programme. Horizon 2020 will also ensure the effective promotion of gender equality and the gender dimension in research and innovation content.

3. Best Practices

Many universities and research institutes, thanks to projects funded by the European Commission, have already started tackling gender equality issues, with the aim to redress gender inequalities, and encourage women to reach their full potential as scientific researchers. The majority of these initiatives may be considered best practices, though the benefits coming from their implementation have not fully emerged, and progresses are still very slow. Three examples of projects are presented below.

3.1. PRAGES- Practising Gender Equality in Science.

PRAGES was initiated in 2008 under FP7 and lasted 21 months.. It was coordinated by the Department for Rights and Equal Opportunities, Presidency of the Council of Ministries (Italy) and the Assembly of women for development and the struggle against social exclusion (ASDO, Italy).

Its aim was to investigate strategies, policies and programmes designed to overcome the under-representation of women in leadership positions in science and technology. It was focussed on the fight against vertical segregation in various professional, political and social areas and in understanding the reasons of the exclusion of women. The project compared also the various strategies implemented for promoting the presence of women in decision-making positions concerning scientific research in public institutions. PRAGES is a valuable example of a new strategy of action integrating awareness raising, empowerment of women and policy making.

3.2. GENDERA - Changing the Gender Balance in Research Organisations

From 2010 to 2012, GENDERA strived to change the gender balance in research organisations in Europe. It was coordinated by TETALAP (Hungarian Science and Technology Foundation, Hungary) and funded through the SiS-Programme (FP7). Its main objective was to create "an enabling environment" to integrate gender dimension into science policy throughout Europe.

Based on available analyses and recommendations aimed to improve the situation of women in science, GENDERA identified and discussed good practices of gender balance on national and European levels, both through networking and workshops.

The project aimed at identifying factors limiting the participation of women in specific scientific fields as well as in decision making positions, and introducing real-life implementation examples to top decision makers in research and higher education institutions. The project provided an online database of good practices accessible to everyone. GENDERA is a good example of awareness raising project finalised to change attitudes and opinions of decision-makers on the relevance of gender equality in order to improve the efficiency of the institutions they are heading and to bring to life the structural change.

3.3. GENSET - Increasing Capacity for Implementing Gender Action Plans in Science

The project GENSET was coordinated by Portia Ltd (UK) and lasted 3 years, from 2009-2012. The overall aim of GENSET was to develop practical ways in which gender knowledge and gender mainstreaming expertise can be incorporated within European science institutions in order to improve individual and collective capacity for action to increase women's participation in science. This was achieved by facilitating a sustainable, collaborative dialogue between gender experts and science leaders to agree on practical guidelines for implementing gender action plans within existing institutional mechanisms. The project was very successful and well-known amongst scientists and science leaders.

The GENSET Consensus Report is an innovative tool, it examines gender at the knowledge level, and supports interdisciplinary dialogue between gender experts and people in "gate-keeping" positions such as university leadership, journal editors, and funding directors.

The project launched also the European Gender Summit, now at its IV edition, that provided a forum for stakeholders from research, industry and policy to jointly explore how gendered methodologies can stimulate innovation and advance scientific excellence.

4. Lessons Learnt

Since the end of the 1990's the European Commission adopted a formal commitment to gender mainstreaming in science, i.e. the systematic incorporation of gender issues by "*Mobilising all policies and measures specifically for the purpose of achieving equality and by actively and openly taking into account from the planning stage their possible effects on the respective situations of men and women*". In other words, gender should be integrated into the formulation and implementation of all EU policies.

Several millions EUR have been invested by European Commission in the promotion of gender equality in science and in modernising research institutions and universities from a gender perspective. While progress has been, and is being made, in reducing gender imbalances, changes come about very slowly. The actual impact of the investment done by the European Commission on gender equality and mainstreaming in science has not yet been evaluated.

At the end of Framework Programme FP5 a Gender Impact Assessment of some of the funded projects was commissioned. The assessment made clear that gender mainstreaming was missing at the level of individual research projects. The results of the study were useful in including gender issues in EU-funded FP6 projects (European Commission 2001). The Gender Impact Assessment was continued in FP6 for some thematic fields but there is great need of similar studies for FP7 funded projects so to achieve the goals of H2020 concerning gender equality and gender mainstreaming.

Gender has prominent focus in Horizon 2020, with the European Parliament and Council stating that "Horizon 2020 shall ensure the effective promotion of gender equality and the gender dimension in research and innovation content" (European Parliament 2013). In order that this is realised, gender balance in research teams and the integration of the gender dimension in research content will play a part in funding decisions under Horizon 2020. The two above mentioned statements "imply a greater ambition in reaching a better gender balance in research and innovation than was the case in the 7th Framework Programme"[3]. And ambitions should be mainstreamed into policy actions and activities.

Gendering research policy should rely on a *soft-policy* mode i.e. it is based on the good-will of member states, stake-holders, managers of universities and research institutions. The major lesson learnt from almost 20 years of commitment of EU towards gender equality in science is that progress is extremely slow. The gendering of innovation policies is still lacking behind; the question of re-addressing power in governing research bodies is far to be solved; some of the policies or measures implemented show no clear correlation with the presence of women in science.

Universities and research institutions play an important role in the transformation of societies as they contribute to social, economic, cultural and political change. They should become aware that achieving gender balance in their management and funding bodies, and including gender equality in every action they implement is not only possible but rewarding, at least in term of efficiency and performance.

Gender is a self-evident aspect of societal diversity and is as such a major source of creativity, discovery and innovation acting as an important factor in quality. "From a larger societal perspective, a balanced gender representation contributes to excellence in research, positively influences research outcomes and impact, and promotes the acceptance of scientific insights, thereby reaffirming the credibility of universities and strengthening their societal role (LERU 2012)."

Awareness raising is a fundamental pre-requisite for every action we want to implement in the field of gender equality. In analysing the projects funded under FP6-FP7, we noticed that there are area of knowledge still scarcely investigated from a gender point of view and that request more attention from the EU (e.g. food, agriculture, energy, tourism, governance, pharmaceutics) .

3 Declaration on Horizon 2020 from Helsinki Group

Gender statistics and indicators, Gender Impact Assessment, gender awareness and Gender Action Plan, were and are leading to progress towards gender equality in science and should be reinforced. Gender budgeting is still lacking on EU-funded projects, although it may have relevant effects, because it incorporates a gender equality perspective into the budgeting process and the policies that underpin it in order to promote equality between women and men.

Cultural change is complex, all-encompassing, slow and hard to measure. Ways have to be found to prioritize amongst the important elements which further structural change in higher education and research institutions and those that are rather more marginal in terms of moving towards gender equality (Müller et al. 2011). Local and small-scale initiatives seem to have a more decisive impact on women's participation in science than large-scale programmes. At the same time, uncoordinated initiatives by governments, research funders and individual universities may create confusion. Strengthening the learning process across many specific and short-term initiatives may help to make steps forward towards gender equality in science.

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Annex 1-Mmain Projects in the Gender Equality Area

FP6 projects

Project Acronym	Project Title	Coordinator (name of organitation and country)	Number of partners involved	Start Date	End Date	Duration (Months)	Total Cost (€)	Total Funding (€)	Contract Type**
ADVANCE	ADVanced TrAining for WomeN in ScientifiC REsearch	UNIVERSITÄT FÜR WEITERBILDUNG KREMS, Austria	6	01-09-2006	31-08-2008	24	456 165	456 165	SSA
BASNET	BALTIC STATES NETWORK "WOMEN IN SCIENCES AND HIGH TECHNOLOGY	UNIVERSITAS VILNENSIS, Lithuania	10	01/01/2006	31-12-2007	12	393 600	393 600	SSA
CECWYS	Central European Centre for Women and Youth in Science	INSTITUTE OF SOCIOLOGY OF THE ACADEMY OF SCIENCES OF THE CZECH REPUBLIC, Czech republic	7	01/03/2004	28-02-2007	36	699860	699860	SSA
DATAWONSCI	Study on databases of women scientists	RHEINISCHE FRIEDRICH-WILHELMS-UNIVERSITAET BONN, Germany	6	01-04-2004	31-01-2005	9	139434	139434	SSA
DIVA	Science in a different voice	CNR- NATIONAL RESEARCH COUNCIL, Italy	1	19-09-2005	18-09-2007	24	116139	116139	SSA
ELSA	Excellence in the Life Sciences Area	KAROLINSKA INSTITUTET, Sweden	1	01-04-2006	31-01-2007	12	90505	90505	SSA
ENCOUWOMSCI	Encouragement to Advance - Training Seminars for Women Scientists	GESIS -GESELLSCHAFT SOZIALWISSENSCHAFTLICHER INFRASTRUKTUREINRICHTUNGEN E.V, Germany	1	01-10-2006	31-12-2008	24	470080	428080	SSA
ERA-GENDER	Women in Science: Mainstreaming gender equality in the European Research Area	UNIVERSITA' DEGLI STUDI ROMA TRE, Italy	1	01-09-2003	29-02-2004	5	39855	39855	SSA
ESGI	European Study of Gender Aspects of Inventions - Statistical survey and analysis of gender impact on inventions	HOCHSCHULE FURTWANGEN UNIVERSITY, Germany	1	01-10-2006	31-01-2009	26	374908	374908	SSA
ENWISE ETHICS	Starting a Debate with Women scientists from Post- communist Countries on Ethical Issues	HUNGARIAN SCIENCE AND TECHNOLOGY FOUNDATION, Hungary	1	01-06-2003	31-08-2004	14	49296	49296	SSA
EUMENT NET	Building a European Network of Academic Mentoring Programmes for Women Scientists	UNIVERSITE DE FRIBOURG, Switzerland	6	01-01-2007	30-09-2008	20	514761	514761	CA
EUROWISTDOM	European Women in Science TV Drama on Message	FEMTEC HOCHSCHUL KARRIEREZENTRUM FUER FRAUEN BERLIN GMBH, Germany	5	01-10-2006	30-/09-2007	12	319300	319300	SSA
FEMSTART	Fostering the public debate on university support of female scientists to start a business	STEINBEIS-EUROPA-ZENTRUM DER STEINBEIS-STIFTUNG FÜR WIRTSCHAFTSFÖRDERUNG, Germany	7	01-09-2006	28-02-2009	28	303740	303740	SSA

GAPP	Gender Awareness Participation Process: Differences in the choices of science careers	FONDAZIONE IDIS - CITTÀ DELLA SCIENZA, Italy	6	01-01-2007	31-12-2008	24	808380	808380	SSA
GB-Management	Gender Budgeting as an instrument for managing scientific organisations to promote equal opportunities for women and men - with the example of universities	FRAUENAKADEMIE MUENCHEN E.V., Germany	4	01-09-2006	31-08-2008	12	215250	218850	SSA
GENDERBASIC	Promoting the integration of the gender dimension in basic research in ERA/FP7	UNIVERSITEIT MAASTRICHT, Netherlands	1	01-10-2005	31-12-2007	27	209782	209782	SSA
IFAC	Information for a choice: Empowering young women through learning for technical professions and science careers	NATIONAL ACCREDITATION CENTER FOR CONTINUING VOCATIONAL TRAINING, Greece	10	01-10-2006	30-09-2008	24	1000000	1000000	CA
KNOWING	Knowledge, Institutions and Gender: an East-West comparative study	INSTITUTE OF SOCIOLOGY OF THE ACADEMY OF SCIENCES OF CZECH REPUBLIC, Czech Republic	8	01-01-2006	31-12-2008	24	984107	984107	STREP
NEWS	Network on ethnicity and women scientists	UNIVERSITE LIBRE DE BRUXELLES, Belgium	8	01-01-2006	31-12-/2007	12	172346	172346	SSA
PALLAS ATHENE	Ambassadors for women and science - Use of best practice instruments to strengthen women in research	DEUTSCHES KREBSFORSCHUNGSZENTRUM, Germany	6	01-11-2005	31-10-2007	24	220000	220000	SSA
PLATWOMSCI	European Platform of Women Scientists	GESIS/GESELLSCHAFT SOZIALWISSENSCHAFTLICHER INFRASTRUKTUREINRICHTUNGEN, Germany	4	01-02-2005	31-10-2008	44	1988010	1988010	SSA
PROMETEA	Empowering Women Engineers Careers in Industrial and Academic Research	CONFÉRENCE DES DIRECTEURS D'ECOLES ET FORMATIONS D'INGÉNIEURS, France	19	01-11-2005	31-12-2007	26	1474471	1220000	STREP
SET-Routes	A pan-European women ambassadors programme bringing role models to schools and universities to stimulate and mobilise girls and young women for studies and careers in SET	EUROPAISCHES LABORATORIUM FUER MOLEKULARBIOLOGIE – EMBL, Germany	3	01-11-2006	30-/04-2009	40	533200	533200	SSA
TANDEMplusIDEA	Information for a choice: Empowering young Women Through Learning for Technical Professions and Science Careers	RHEINISCH-WESTFÄLISCHE TECHNISCHE HOCHSCHULE AACHEN (RWTH), Germany	4	01-04-2007	31-03-2010	36	466020	466020	CA

TRANSGEN	Gender Mainstreaming European Transport Research and Policies. Building the Knowledge Basis and mapping good practices	KOBENHAVNS UNIVERSITET, Denmark	1	01-10-2006	30-09-2007	12	160211	160211	SSA
UNICAFE	Survey of the University Career of Female Scientists at Life Sciences versus Technical Universities	TUDOMANYOS ES TECHNOLOGIAI ALAPITVANY, Hungary	8	01-11-2006	31-10-2008	24	325000	325000	SSA
UPGEM	Understanding Puzzles in the Gendered European Map Brain Drain in Physics through the Cultural Looking Glass	AARHUS UNIVERSITET, Danmarks Paedagogiske Universitetsskole, Denmark	7	01-09-2005	30-09-2008	37	827292	827292	STREP
WIST	Women in Innovation, Science and Technology	UNIVERSITY OF NEWCASTLE UPON TYNE, UK	5	01-09-2006	30-06-2008	22	399975	399975	CA
WOMBIT	Women on Biotechnology Scientific and feminist approaches	FONDAZIONE GIACOMO BRODOLINI, Italy	1	01-10-2006	30-09-2007	12	288252	288252	SSA
WOMENCORE	WOMEN in COnstruction scientific REsearch	FUNDACION LABEIN, Spain	7	01-04-2006	31-12-2008	32	2042852	1336057	STREP
WOMENINNANO	Strengthening the role of women scientists in Nano-Science	LEIBNIZ-INSTITUT FUER FESTKOERPER- UND WERKSTOFFFORSCHUNG DRESDEN E.V., Germany	11	01-10-2005	31-03-2008	30	533860	533860	SSA
WOSISTER	Women Scientists in Gender-Specific Technological R&D - How do Women Scientists in Technological R&D Respond to the Needs of Women End-Users?	LUNDS UNIVERSITET, Sweden	3	01-10-2005	30-09-2008	36	472420	472420	SSA
WSDEBATE	Stimulating Policy Debate on Women and Science Issues in Central Europe	TUDOMANYOS ES TECHNOLOGIAI ALAPITVANY, Hungary	5	01-10-2006	30-09-2008	24	255700	255700	SSA

Source: CORDIS Open Data - provisional list to be refined for the Stocktaking Final Report

***CA:Coordination (or networking) actions; SSA: Specific Support Action; STREP: Specific Targeted Research Project CP-FP - Small or medium-scale focused research project, CSA: Coordination and Support Action*

FP7projects

Project Acronym	Project Title	Coordinating organization	Number of partners	Start Date	End Date	Duration (Months)	Total Cost (€)	Total Funding (€)	Contract Type**
ACUMEN	Academic Careers Understood through Measurement and Norms	UNIVERSITEIT LEIDEN, Netherlands	10	01-03-2011	28-02-2014	36	2025808	1495412	CP-FP
DIVERSITY	Improving the gender diversity management in materials research institutions	LEIBNIZ-INSTITUT FUER FESTKOERPER- UND WERKSTOFFFORSCHUNG DRESDEN E.V., Germany	14	01-01-2009	31-12-2011	36	415268	315083	CSA-SA
EGERA*	Effective Gender Equality in Research and the Academia	FONDATION NATIONALE DES SCIENCES POLITIQUES, France	8	01-01-2014	31-12-2017	36	3927352	2229155	CSA-SA
EPSW	European platform of women scientists	CEWS (CENTER OF EXCELLENCE WOMEN AND SCIENCE), Germany	1	01-11-2008	31-10-2009	12	839648	599122	SSA
FESTA*	Female Empowerment in Science and Technology Academia	UPPSALA UNIVERSITET, Sweden	7	01-02-2012	31-01-2017	48	4291096	2569180	SA
GARCIA*	Gendering the Academy and Research: combating Career Instability and Asymmetries	UNIVERSITA DEGLI STUDI DI TRENTO, Italy	7	01-02-2014	31-01-2017	36	3572250	2297826	CSA-SA
GENDERA	Gender Debate in the European Research Area	TUDOMANYOS ES TECHNOLOGIAI, Hungary ALAPITVANY	9	01-11-2009	30-04-2012	29	1030585	798666	CSA-SA
GENDERNET*	Promoting gender equality in research institutions and the integration of the gender dimension in research contents	CONSEIL NATIONAL DES INGENIEURS ET DES SCIENTIFIQUES DE France, France	12	15-10-2013	14-10-2016	36	1931665	1545219	CA
GENDERTIME*	Transfering Implementing Monitoring Equality	EGALITE DES CHANCES DANS LES ETUDESET LA PROFESSION D'INGENIEUR EN EUROPE ASSOCIACION, France	10	01-01-2013	31-12-2016	36	3329404	2328077	CSA-SA
GENISLAB*	The Gender in Science and Technology LAB	FONDAZIONE GIACOMO BRODOLINI, Italy	9	01-01-2011	31-12-2014	36	2393332	1674932	CSA-SA
GENOVATE*	Transforming organisational culture for gender equality in research and innovation	SITY OF BRADFORD, UK	7	01-01-2013	31-12-2016	36	3185139	2200332	CSA-SA
GENPORT*	An internet portal for sharing knowledge and inspiring collaborative action on gender and science	FUNDACIO PER A LA UNIVERSITAT OBERTA DE CATALUNYA, Spain	6	15-05-/2013	14-05-2017	48	1673376	1496372	CSA-SA

GENSET	Increasing capacity for implementing gender action plans in science	PORTIA, UK	4	01-09-2009	29-02-2012	41	1036232	1198630	CSA-SA
HELENA	Higher education leading to engineering and scientific careers	SIAULIU UNIVERSITETAS, Lithuania	7	01-04-2009	30-09-2011	29	930433	1212390	CSA-SA
ICWES14	14th international conference of women engineers and scientists "a changing world: new opportunities for women engineers and scientists"	CONSEIL NATIONAL DES INGENIEURS ET DES SCIENTIFIQUES DE France, France	1	01-09-2007	31-08-2008	12	593770	100000	CSA-SA
INTEGER*	INstitutional Transformation for Effecting Gender Equality in Research	CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE, France	5	01-03-2011	30-06-2015	39	3568019	2247705	CSA-SA
IRIS	IRIS - interests & recruitment in science. Factors influencing recruitment, retention and gender equity in science, technology and mathematics higher education	UNIVERSITETET I OSLO, Norway	6	01-05-2009	30-/04-2012	36	999584	1284514	CP-FP
MOTIVATION	Promoting positive images of SET in young people	BERGISCHE UNIVERSITAET WUPPERTAL, Germany	8	01-01-2008	31-12-2009	24	536488	499888	CA
PRAGES	Practising gender equality in science	DIPARTIMENTO PER I DIRITTI E LE PARI OPPORTUNITA, Italy	11	01-04-2008	31-12-2009	20	1498040	998418	CSA-SA
SAPGERIC	Structural Change Promoting Gender Equality in Research Organisations	VILNIAUS UNIVERSITETAS, Lithuania	1	09-05-2013	08-05-2014	12	450398	299996	CSA-SA
SHEMERA	Euro-Mediterranean research cooperation on gender and science: SHE Euro-Mediterranean Research Area	UNIVERSITE LIBRE DE BRUXELLES, Belgium	18	01-05-2011	30-04-2014	24	2372195	1991838	CP-FP
STAGES*	Structural Transformation to Achieve Gender Equality in Science	DIPARTIMENTO PER I DIRITTI E LE PARI OPPORTUNITA, Italy	7	01-01-2012	31-12-2015	48	4647496	2789759	CSA-SA
TRIGGER*	TRansforming Institutions by Gendering contents and Gaining Equality in Research	DIPARTIMENTO PER I DIRITTI E LE PARI OPPORTUNITA, Italy	5	01-01-2014	31-12-2017	48	2179369	3767200	CSA-SA

TWIST	Towards Women In Science and Technology	CENTER FOR FORMIDLING AF NATURVIDENSKAB OG MODERNE TEKNOLOGI FOND, Denmark	11	01-01-2010	31-12-2012	24	3048097	2755692	CSA-SA
WHIST	Women's careers hitting the target: gender management in scientific and technological research	DIPARTIMENTO PER I DIRITTI E LE PARI OPPORTUNITA, Italy	6	01-05-2009	30-11-2011	31	1146582	663558	CSA-SA

Source: CORDIS Open Data - provisional list to be refined for the Stocktaking Final Report

** Projects under execution*

***CA:Coordination (or networking) actions; SSA: Specific Support Action; STREP: Specific Targeted Research Project CP-FP - Small or medium-scale focused research project, CSA: Coordination and Support Action*

Science Education
What Science to Study and Why

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Over the last fifteen years, the European Commission (EC) has been actively supporting the improvement of science education, taking into account the observation that in many countries fewer young people seem to be interested in science and technical subjects. Apparently, this is an issue, which has turned out to be *an endless nest of Chinese boxes*. A complex set of research questions surrounds the central point: Why study science?

For several decades now, scientists have proposed answers that involve different interdisciplinary aspects, such as the insights of the scientific method, pedagogical issues, as well as the conception of the role of science in society and of citizens in society. This led to the identification of some crucial *dimensions* of science education which – throughout the course of the EU's sixth and seventh Framework Programmes for Research and Technological Development (FP6/FP7) – can also be recognised in the objectives pursued by the EC's 'Science and Society' (SaS) and 'Science in Society' (SiS) programmes.

1. Science Education – Arguments and Priorities in the Scientific Debate and Across FP6/FP7

1.1 Science Education Arguments

Almost 30 years ago, Bodmer Report stressed that "Public understanding of science has as its base the teaching of science in schools"[4] (The Royal Society 1985). The Bodmer Report outlined crucial dimensions of science comprehension and learning, having as a starting point the cultural argument, according to which the extraordinary discoveries made by science "profoundly influence the way we think about ourselves" (The Royal Society 1985).

Subsequently, scientific debates involved the core features of new and old views on science education and communication. Turner describes "school science and its controversies" (Turner 2008), based on the five dimensions proposed by Millar[5] (Millar 1996) – namely: economic, utility, democratic, social, cultural. These dimensions represent the main reasons for studying science. The related arguments, which particularly address 'why' science should be studied, have had considerable influence on 'what science to teach' and 'how to teach it'.

The *cultural* argument derives from the idea that science is a major achievement of our culture and that

4 In the summary of the Bodmer Report, it is also stated that: "A proper science education at school must provide the ultimate basis for an adequate understanding of science".

5 The circumstance that Millar analysed these five arguments for Science Education, moving from the nine benefits stemming from Public Understanding of Science presented by Thomas and Durant (Thomas e Durant 1987), reveals the proximity of the two research fields: science communication and science education. Very briefly, the nine benefits presented by Thomas and Durant are related to: science itself, national economies, national power and influence, individuals, democratic government, society, intellectual culture, aesthetics, and ethics.

there are benefits for young people in being able to understand and appreciate science. It includes a decade of research on the nature of science (NoS), as well as on teachers' and students' conceptions of science (Lederman 1992). The selection of the core NoS issues to be taught in the classroom is closely related to how they should be taught (Osborne et al. 2003). By renaming the NoS elements as *Feature of Science* (FoS) (Yalaki e Çakmakcı 2010), Matthews introduces another question – this of why such a selection is made "and not other of the numerous features that can be said to characterise scientific endeavour".

The argument of *utility* is also closely linked to the cultural one, since scientific understanding helps individuals make better decisions. One main goal of science education should, therefore, be to combine the explanation of the material world that science offers with the understanding of how science actually works.

Thereafter, the *democratic* argument brings in the question of citizens' informed participation in decision making, especially in regard to policy issues that increasingly include techno-scientific components. For instance, in the discussions on curriculum reform, this argument, together with considerations of efficacy, often counter-balances the approach of science curricula being seen as strictly routes towards science careers. If one looks at the following statement, to wit: "a more educated citizenry is trained in science and technology issues to be able to participate in policy debate" – one of the goals in the strategic view of the European Research Area (ERA) Board to be achieved by 2030 (European Research Advisory Board 2005)(European Commission 2009) – it appears that the democratic argument has been specifically considered also by ERA.[6]

A further reason to study science, relates to the *economic* argument, which refers to the idea that economic well-being relies on bringing enough scientifically qualified personnel into the labour market. Engaging and drawing people's interest in scientific careers has persistently been connected to the economic dimension. As also underlined by the Wolfendale Report, there is a relationship between economic well-being and inclusion of young people in scientific and technological related careers (Wolfendale Report 1995).

Be that as it may, approaches that focus solely on encouraging young people towards scientific careers, have been questioned as paying rather limited attention to the relationship between demand and supply (Osborne e Dillon 2008). Evidence exists showing that curricula developed with the sole aim of preparing young people for obtaining a science degree fail to actually engage young people with the further study of science. They equally do not stimulate curiosity and motivation of most students. Naturally, students, "require a broad overview of the ideas that science offers, how it produces reliable knowledge and the limits to certainty" (Osborne e Dillon 2008).

Finally, the *social* argument – considering the social benefits to be obtained from integrating scientific and humanistic cultures – is particularly related to the effects that the development of science education has brought to society. This argument is also relevant within the context of Responsible Research and Innovation (RRI) of which science education is an integral part and is linked, at the same time, to a range of other 'cross-cutting' issues, including public engagement, gender, open access and ethics. By way of illustration, consideration of 'open access' leads to further considerations of 'open science', in which research processes are made accessible to public scrutiny. In turn, this links to public engagement, and so on.

Moving from the social and democratic issues included in this frame, we may further stress the *participative* argument. Science education should help citizens faced with science and technology issues to behave neither just as "users" nor just as 'producers' of science and technology applications, for which the term "produsage" has been created (Bruns 2008; Marinelli e Ferri 2010), but as "knowledgeable citizens" (Jasanoff, Sheila 2011). These are well-informed and educated citizens, able to manage knowledge and to take an active part in decision-making processes related to their own personal and social spheres.

Europeans value all the aforementioned arguments for science education. The two most recent Eurobarometers

6 "ERA is a unified research area open to the world based on the Internal market, in which researchers, scientific knowledge and technology circulate freely. Through ERA, the Union and its Member States will strengthen their scientific and technological bases, their competitiveness and their capacity to collectively address grand challenges". More information and documents can be found at the relevant website:

http://ec.europa.eu/research/era/index_en.htm

on *Science and Technology* reveal general agreement with the three statements related to the democratic, cultural and career arguments (European Commission 2013a) (fig.1). These results show that European citizen's opinions are aligned with academic scientific debate and with the EU agenda.

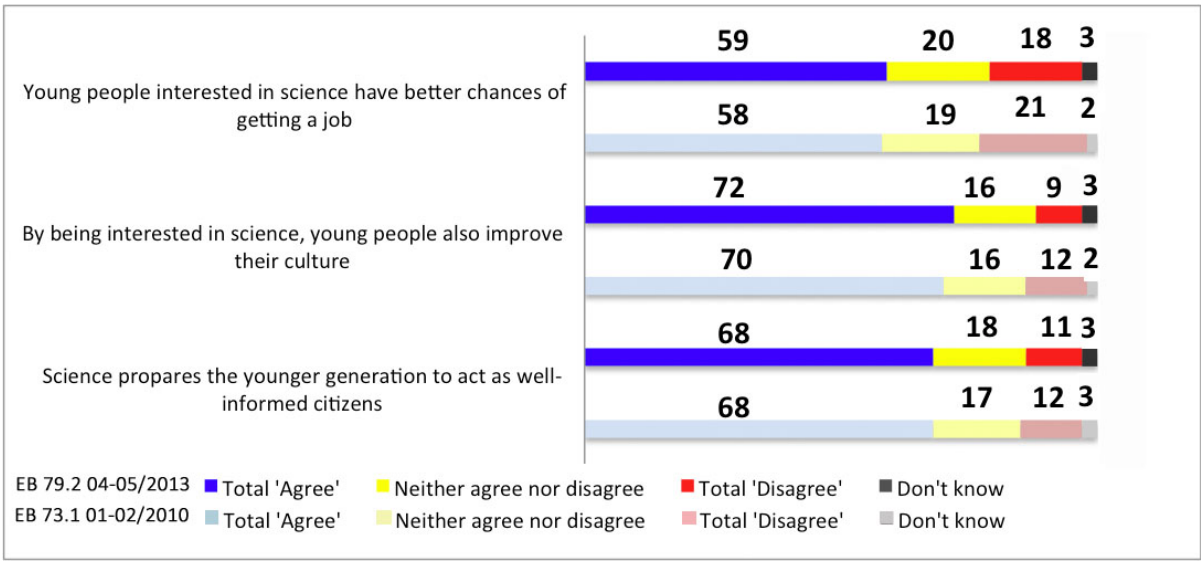

Figure 1. Europeans' Opinion of the Benefits of Science Education on Young People

Source: Special Eurobarometer 401 Responsible Research and Innovation (RRI), Science and T echnology. Level of agreement on statements (European Commission 2013a)

1.2 Science Education Highlights within FP6/FP7

Alongside the scholarly arguments, beginning with the Lisbon Summit in 2000, the EU Council and the EC produced several documents setting out the way towards a European knowledge based society, the creation of the European Research Area (ERA), and pointed out policy making issues for "science society and the citizen in Europe" (European Commission 2000). Alike, international institutions, such as the OECD, as well as other public and private organizations, equally contributed to the body of knowledge on the state of affairs, and perspectives on, science education and related issues. An overview of EU related actions, as well as documents in the field of science education is given in Table 1[7] below.

Table 1 - Highlights in the field of science education

2000	Report: Science, society and the citizen in Europe, EC
2001	EC Science and Society Action Plan
2002	Communication from the Commission of 20 November 2002 on European benchmarks in education and training: follow-up to the Lisbon European Council
2003	First Science and Society call on Science Education
2003	Communication from the Commission - "Education & Training 2010": The success of the Lisbon Strategy hinges on urgent reforms
2004	Constitution of High Level Group on Human Resource for Science and Technology
2004	Report: Europe Needs More Scientists

7 Table 1 is an author's elaboration that includes: main documents and initiatives by the EC in Science Education and related fields; documents promoted or supported by the EC, but produced by other organizations and workgroups; documents (i.e. 2006 OECD Policy Report) that have been specifically debated at an EU level and cited in the latter. See analytical references at the back.

2004	Calls in Science and Society include career dimension
2005	European Research Advisory Board Report: "Science in Society": an agenda for a responsive and responsible European science in FP7
2006	OECD Policy Report: Evolution of student interest in Science and Technology Studies
2007	Mid-Term assessment of Science and Society activities
2007	Rocard Report: Science education now: a renewed pedagogy for the future of Europe
2007	Work programme Science in Society
2008	Report to the Nuffield Foundation Science Education in Europe: a critical reflection
2009	European Research Area Board Final Report: Preparing Europe for a New Renaissance
2009	Council conclusions of 12 May 2009 on a strategic framework for European cooperation on education and training ('ET 2020')
2010	Mobilization and Mutual Learning Action Plans, encompassing a series of SiS actions, including science education and public engagement
2011	Eurydice Report Science education in Europe: national policies, practices and research
2012	MASIS final synthesis Report
2012	Technopolis Report: Interim evaluation and assessment of future options for Science in Society actions
2013	Horizon 2020 work programme: 2014-2015 Science with and for Society. Making science education and careers attractive for young people

Since the Lisbon Summit, heads of state and government across Europe have been stressing the need to boost substantially the number of people opting for science and technology careers. The first response of the EC to this end, was through the Science and Society Action Plan (European Commission 2002a), one of the main cornerstones in the field, in which room was given to issues related to young people, science education and careers, including mathematics, science and technology. The action plan also dealt with adult education and, in nuce, includes socio-cultural, democratic and economic-career arguments concerning science education. The importance of bringing together research and education partners was also envisaged.

FP6 has been the main instrument to implement ERA, which intended to overcome the problem of fragmented and overlapping research and related actions across Europe. The Science and Society Action Plan was subsequently adopted, making the 'Science and Society' theme under Structuring the ERA in the Sixth Framework Programme (FP6) "the first ever initiative in this field at the European level scale" (European Commission 2007a). As from 2002 and up to 2006, several calls specifically addressed Science Education, one of the pillars of European strategy within FP6 'Science and Society' (SaS) Programme. During the transition from FP6 to FP7, another initiative in the field of Science Education led to the constitution of the High Level Group on Human Resource for Science and Technology that produced the so-called 'Europe Needs More Scientists' report (European Commission 2004). The report considers the results of the 2002 European summit in Barcelona, in which heads of state called for an increase of European Gross Domestic Product (GDP) invested in research, and also defined strategic views on careers, including considerations regarding curricula, school system and science education.

In 2005, the European Research Advisory Board Final Report outlined some (new) directions for the forthcoming FP7; to wit: the centrality of young people and children; the necessity to cultivate interest for science and research "from an early age"; the importance of "well informed and engaged teachers" (European Research Advisory Board 2005). Starting with FP6 and throughout FP7, the EU made a great effort to promote science education. In 2012, 21 projects had already been financed within FP7 with reference to young people and science, for a total of EUR 41,253,000. Considering that by that time the total financial support to the 122 'Science in Society' (SiS) projects amounted to EUR 143,510,000, the projects supporting science education and careers received a relatively high amount of the whole funding stream, representing approximately 28,7%, both due to their pivotal role within the EC strategy and to their implementation needs.

In terms of publications the output resulting from EC funding is likely to be substantial. The publication profiles of researchers supported by the FP6/FP7 SaS/SiS programmes have been analysed for the period 2003-2010. The bibliographic analysis has been carried out by Science Metrix, calculating the profile of publications indexed in Scopus within main SaS/SiS fields and comparing the profiles with those of Framework Programme supported research (Technopolis-Fraunhofer 2012). The distribution of these publications in some main areas, among which 'Science Education',is presented in Table 2.

Table 2 - Number of Papers Published in Selected Areas of SiS Research by FP Researchers 2003-2010

Country/Group	SIS		General Science & Society		Science Ethics		Science Education		Women & Minorities		Science Communication	
World	23,918	100%	9,455	40%	8,224	34%	5,364	22%	1,090	5%	697	3%
ERA	9,018	100%	3,953	44%	3,062	34%	1,772	20%	252	3%	265	3%
FP6 SaS Researchers	452	100%	100	22%	268	59%	69	15%	20	4%	27	6%
FP7 SiS Researches	515	100%	132	26%	154	30%	228	44%	8	2%	32	6%
TOTAL (SaS & SiS res.)	847	100%	209	25%	371	44%	251	30%	25	3%	47	6%

Source: Computed by Science-Metrix from Scopus (Elsevier)

Data processing: Interim evaluation & assessment of future options for Science in Society Actions (Technopolis-Fraunhofer 2012)

The 'General Science & Society' area, covering mainly general aspects of the topic, includes 40% of papers at world level. Aside from this general topic, *Science Education*, with 22% of papers, comprises the second largest area after *Science Ethics*.

In Science Education, FP6 researchers seem to have been relatively less active than ERA (15% *vs* 20%), whilst the supported research in FP7 has a proportion of papers in this area twice that of the ERA average.

Comparing FP6/FP7 publications in the field of Science Education, we can see that researchers supported by FP7 got higher percentage than those supported by FP6 (44% *vs* 15%). The Technopolis Interim Report also explains that FP6 publications are more than 20% less than expected in the area, based on the world distribution.

The interpretation of this data cannot be unequivocal, and is also related to the economic support given from the EC under FP7. On the one hand, it is legitimate to hypothesize that FP6 prepared the ground for scientific results that lead to publications produced within FP7. On the other hand, FP7 calls are more oriented to specific issues like careers and inquiry based science education; thus, publications may have found their way more easily into journals following mainstream issues.

It can also be argued that publication statistics are not the only relevant indicator for project impact. Many of the SiS projects, namely the:"Coordination and Support Actions" (CSA), had no mandate for performing research; Consequently they produced effects directly related to practice. There is some debate (e.g. INSTEM, 2014) regarding the possibility of measuring these effects in the absence of long term studies running in parallel with, and beyond the duration of, such projects.

Another initiative to monitor research activities with respect to Science in Society in Europe was represented by the MASIS project (European Commission 2012). Although based on heterogeneous country reports, MASIS improves our knowledge about national level policies and activities. Based on MASIS, some papers further analysed issues related to the location, role and responsibility of science across EU member states (Mejlgaard e Bloch 2012; Mejlgaard et al. 2012).

The above mentioned cornerstones and the density of activities, as well as of discourse that they represent, may give an idea of how EC support has been determinant in different directions: implementing innovative methodologies of science education; catalysing main arguments related to the theory and practice of science education; promoting actions and projects which further contributed to the production and sharing of knowledge and lesson-drawing in the field. All these considerations will be further substantiated in the next part of this paper.

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2. Calls and Projects in Science Education

2.1 The Variety of Science Education Arguments in FP6

The cultural and utility arguments of science education have been considered from the first SaS calls, which focused on providing teachers, science professionals and educational specialists with tools and opportunities to share ideas, techniques and methods to supplement science curricula and develop educational strategies, aimed at increasing the attractiveness and relevance of science studies at school.

Many EC funded projects aimed to integrate formal and informal science education and at fostering collaboration between different stakeholders. Some examples of projects can give an idea of the variety of aims and strategies, as well as of certain important features that would then be deepened in the next FP7 programme. In most projects, teachers are central figures, as their competence, role and contribution are crucial for young people growing up, particularly in science.[8]

The central role of teachers is acknowledged also in the projects that specifically tackle the social argument of integrating scientific and humanistic culture. An example is the CISCI project on cinema and science.

Among the successful projects of the first SaS calls, SCIENCEDUC had two important features. It was based on relevant experience accumulated by partners in inquiry based learning (IBL) from an early education stage onwards, and was aimed at involving multiple stakeholders, including teachers, students and policy makers.

The next calls (2004-2006) explicitly added the career argument and continued to emphasise the central role of teachers. The projects that mainly based on teaching methods equally included the need to overcome gender and inequalities in order to promote scientific careers. Innovation in science education followed the evidence, which showed that reforming science teacher education is crucial for the success of other science education reforms (Abell, Sandra K. 2000).

Practices in science teaching are considered vital for any improvement of pupil motivation, learning and attitudes towards science, and any curriculum or educational reforms need to take teachers' attitudes and capacities into account.

The POLLEN project, which was centred on the renewal of science education in primary schools, based on an inquiry approach, promoted the wide participation of teachers, educators, researchers, students and parents, whose cooperation and awareness is very important when dealing with young students.

A variety of practices characterised these science education projects, with success stories that originate from different perspectives. ECFUN, European Children's Future University Network, for example, aimed at creating a direct link between scientists and children, placing the student at the centre and emphasising the democratic argument of science at a very early stage. ECFUN brought together local activities and experiences of European Universities and Foundations to increase children's and young people's interest in science.

The project GAPP was open to a variety of stakeholders, and focused on gender differences in the choice of science careers. It represented a middle path between education and science communication, aimed at developing and implementing new participative practices in these contexts.

The FORM-IT project – "Take part in research" – created a network of experts working with new didactic concepts for science teaching, thus facilitating partnerships between universities and schools. As an intermediate outcome, FORM-IT built up a catalogue of good practices of cooperation between research and education in the member states, including, among national successful experiences, a variety of contexts and approaches to formal and informal education.

Some FP6 calls aimed at promoting science weeks and events, sharing with the calls strictly devoted to science

8 A complete list of all PFS SaS projects can be found in EC sites and publications (European Commission 2007b)

education the cultural and career arguments, and also embracing the social paradigm of science. Some of these projects included schools among their target users, such as the ESCIENTIAL.IE project, which widened the implementation of European Science Festivals.

2.2 Science Education in FP7: Reflection on Achievements and Wide Experimentation of Inquiry Based Learning Methodologies

In 2006-2007, the years of the shift between FP6 and FP7, two international reports gathered the attention of science education researchers and practitioners. The first, the policy report Evolution of student interest in Science and Technology Studies (STS), stressed once again the problem of decreasing percentage of young people choosing STS at universities in most European countries. To get youth closer to scientific careers, "teaching should concentrate more on scientific concepts and methods rather than on retaining information only" (OECD, Global Science Forum 2006).

The second document Science education now: a renewed pedagogy for the future of Europe, also known as the Rocard Report, synthesizing some major achievements of previous projects and related methodologies, centred on the 'inquiry based learning approach' (IBL), which actually formed the basis for the next calls. Thanks to this report, further attention was placed on "bottom up" inductive pedagogical approaches. Inquiry based methodologies, already included in preceding research projects as crucial for making science more attractive to young people, were now explicitly addressed as paradigmatic models for teaching and learning, and were also considered as a way to overcome inequalities (European Commission, High Level Group on Science Education 2007).

In 2006-2008, the results of periodical international surveys, such as the OECD-PISA and TIMMS, showed that many countries were increasingly concerned with the unattractiveness of science for young people and with the insufficient diffusion of scientific culture. The "significant overall increase in the total number of graduates" in STEM desired by 2010 was, apparently not going to be accomplished (European Commission 2002b).

The economic-career argument present in the second period of FP6 calls was reiterated in FP7 and becomes a catalyst for the development of other arguments on science education.

The expected benefits for all have been stressed by the Technopolis Report: "Through this agenda, the expected outputs can be seen to be of benefit to all European citizens insofar as they improve our prospects for future growth and competitiveness and enable solutions to the key socio-economic challenges of the present and future" (Technopolis-Fraunhofer 2012).

Within FP7, the tendency to implement most of the described arguments of science education – economic/career, utility', democratic, social', cultural, participative - seems to have been accomplished. For this, particular stress is laid upon IBL, inquiry based science education (IBSE) and inquiry based science and mathematics education (IBSME) methodologies.

As IBSE is based on an inductive approach, on observation more than on a "top down transmission", and on "teacher-guided construction by the child of his/her own knowledge" (European Commission, High Level Group on Science Education 2007), the role of teacher training should be adequate to this major effort. FP7 calls were further aimed at reinforcing the central role of teachers, the importance of teacher training, and including teachers in the research process, according to the principles of the 'action research' approach. Improvements in science education must include new forms of pedagogy: the introduction of inquiry-based approaches in schools, actions for teacher training in IBSE, and the development of teachers' networks, were considered the best way to actively promote and support these improvements.

In FP7 calls, IBSE was recognised as a pillar to enhance science education, allowing many relevant and valuable

projects to be performed.. It is worth point out the fact that more than half of the EC financed projects explicitly mentioned 'inquiry based learning' or 'inquiry based education in their descriptive abstracts.

The downside of this wide experimentation with inquiry methodologies in Europe has been that "very few projects have been tasked explicitly with producing formal research to evidence the effectiveness (or relative effectiveness) of the IBL approach" (Technopolis-Fraunhofer 2012).

Some examples of science education SiS projects are described below. Other successful projects, including projects that dealt with science education from a specific gender perspective, have been mentioned in the Technopolis Report[9] (Technopolis-Fraunhofer 2012). A complete list of FP7 projects in science education organised by calls can be found in an EC RTD presentation of September 2013 (Korda and Karamitrou 2013).

Although most science education SiS projects shared similar approaches in answering very specific calls promoting IBL and IBSE, some differences can be found in the modalities of addressing the main issues, as well as in focusing specific aspects of science education.

For this reason, examples of science education SiS projects have been clustered hereunder, under five categories, according to specific issues and strategies implemented by projects, relevant for achieving the goal of improving science education and fostering the way towards scientific careers.

Adapting to National Contexts

Some projects specifically addressed the problem of "translating" inquiry-based methods into local contexts.

KidsINNscience aimed at developing adaptive strategies to facilitate innovation of science education in formal and informal settings. Innovative curricula, as well asteaching and learning methodologies have been analysed, and compared, among different countries in Europe and Latin America, considering among others also gender issues and cultural diversity. The process of reciprocal learning went side-by-side with developing plans to fit the country contexts and specificities.

Thereafter, in S-TEAM particular importance was given to Teacher Professional Development (TPD). The project also disseminated research on teacher's experiences of inquiry-based methods to existing and future science teachers, involving listening to teachers, working with teacher educators and researchers, and providing support for better science education. Particular attention was paid to 'national specific contexts' as an optimum 'area for action', where TPD can be consistent with the national opportunities and constraints.

TRACES adapted actions to the needs and priorities of the consortium partners' own national and local context, touching different science and mathematics topics and different educational and sociological issues.

The Multiplier Approach

Examples of projects that have been able to pursue a 'multiplier' approach – in other words, a cascade effect of training and awareness – include Fibonacci that aimed at improving the widespread use of IBL in mathematics, and INQUIRE, in science.

Fibonacci organised a dissemination model based on a systematic approach of IBSME at grassroots level, ensured by intermediary structures with successful experience in local IBSME implementation.

9 The Technopolis Report, in addition to some of the projects presented in this document, also mentioned: UPDATE, SET-Routes, HELENA, ACUMEN, SED, EUCYS, EUCUNET, MOTIVATION, and YOSCIWEB.

INQUIRE supported teachers and science educators to develop their proficiency in inquiry based teaching and become reflective practitioners. As IBSE is not practiced in most European classrooms, INQUIRE offered a one-year practically based IBSE teacher training course, run in Botanic Gardens and Natural History Museums, to reach out to a larger number of teachers.

Networks and Portals

Many projects enhanced teacher and stakeholder networks. Scientix built an online portal to collect and disseminate European science, technology, engineering and mathematics (STEM) education projects and their results, mainly addressed to teachers, researchers/project managers and policy makers. The second phase of Scientix intends to expand at the national level, and among others, to reaching national teacher communities through the established network of the National Contact Points (NCPs) in almost 30 European countries.

Another interesting portal is that created by PRIMAS, which developed materials for direct use in the classroom and for professional development, supporting teachers to develop inquiry-based learning pedagogies in mathematics and science, in order to extend the number of pupils who get experience of scientific inquiry. Teachers and educational experts from different countries constituted a network for promoting these learning methods in schools of EU Member States.

Widen the Range of Stakeholders Involved

ESTABLISH and SIS CATALYST made a big effort to widen the network beyond strictly educational actors, aiming to include multiple actors, such as parents, business leaders and policymakers.

SIS CATALYST has also been pivotal for mobilisation and mutual learning (MML) in this area, as it is involved in reciprocal learning and supporting the variety of actors engaged with children. Within SiS CATALYST, children are fully recognised as 'change agents', able to be 'catalysts' in finding what's hardest: solutions to future challenges for European society. The project centred on the aim of Mobilisation and Mutual Learning Action Plans to foster large-scale, long-term partnerships, connecting and engaging various actors and stakeholders, and finding solutions through mutual learning and cooperation.

ESTABLISH aimed at introducing changes in classroom practice through the promotion of IBSE, as well as through the involvement of different stakeholders. In producing teaching and learning units, efforts have been made to link scientific concepts and contents to real-world scientific and industrial experiences.

Careers

Some projects explored alternative strategies to IBSE or IBL implementation, in order to enable and/or facilitate recruitment in science careers.

Among these projects, SECURE aimed to provide useful research data for policy makers to improve mathematics, science and technology (MST) curricula and their implementation. For this purpose, transnational comparative screening of MST curricula has been performed, as well as teacher and learner surveys and lesson observation.

From a different perspective, ECB/Ingenious aimed at reinforcing the partnership between industry and education, in order to foster science and technology careers in the private sector by developing a repository of good practices.

IRIS is interesting as being an ideal continuation of the ROSE project, which involved researchers and practitioners from many countries to better understand the social and affective dimensions of attitudes to science education (Sjøberg e Schreiner 2010). The project was based on experimentation with education strategies, through quantitative and qualitative interviews with STM students, paying attention to gender issues. IRIS has drawn on different theoretical frameworks to address young people's educational choice processes and their relationship to STEM, showing that educational choice is not a purely rational decision.

2.3 Science Education from SaS/SiS to Science with and for Society

Horizon 2020 has included in the general programme some of these perspectives, in particular: promoting sustainable and crosscutting interaction between the relevant actors and strengthening their engagement with education and careers. Responsible Research and Innovation (RRI) envisages that all societal actors – researchers, citizens, policymakers, and business – shall work together during the whole research and innovation (R&I) process. Following this approach, Science with and for Society aims to "build effective cooperation between science and society, to recruit new talent for science and to pair scientific excellence with social awareness and responsibility" (European Commission 2013b).

The first calls devoted to science education acknowledge the central role of education, considering both formal and informal science education, higher education curricula, gender equality and innovative ways to make both science education and scientific careers more attractive to young people. Moreover, the Euraxess - Researchers in Motion, promoted by the European Research Area, is devoted to enhancing the mobility of researchers and their career development.

The expecting impact of the programme covers core arguments of science education: 'democratic/participative' arguments, with attention to the development of scientific citizenship and the emphasis on gender issues; 'cultural/social' argument, in promoting innovative pedagogies in science education and developing responsible research and innovation in higher education curricula; 'economic/career' arguments, in simplifying the access to scientific careers as well as in promoting the pursuing of careers in Stem and, as explicitly specified, in the wide area of innovation.

3. Tentative Remarks and Lessons for the Future

The above examples of science education projects illustrate the great deal of research developed in recent years in this field under EC funding. This research has proved to be highly interdisciplinary, to involve different partners and stakeholders, and in many cases to be committed to a networking approach and to foster a participatory approach that led both to consolidated benefits and future challenges.

Moving from these considerations, the following four issues – *Participative dimension, Widening actors, committing stakeholders, Networking, Impact knot* – are used as *keys* to draw a conclusion that also includes insights for the future.

Participative Dimension

Science education may and should be one of the instruments of a responsible approach to science and technology governance (Nielsen 2014). As RRI is seeking to harmonize research and innovation with societal demands and values (Sutcliffe 2011), science education should further enhance its democratic and participative arguments, including the awareness of values that are embedded in the study of science. In FP6/FP7, bridges have been built between science education and participation and engagement, as is witnessed by the inquiry based learning approach itself and by the number of projects that include both perspectives. Several FP6 and FP7 EC funded projects share this double approach, including science education and participation/engagement –

from ECFUN and ESCIENTAL, to SIS CATALYST AND YOSCIWEB, brining actually together the two research fields. SIS CATALYST also included the ethical perspective, dealing with the ethical guidelines needed when working with children.

We can also find relevant cases in which this tendency has been followed outside SaS and SiS. For example, reference can be made here to the SSH project Biohead-Citizen, in which interests in science education and teacher professional development have been pursued, together with the analysis of implicit values embedded in science textbooks and in science teaching.

By means of consolidating the participative argument, engagement in Science Education has also affected the governance process. This process can be pivotal for a virtuous circle that includes relevant actors inside and outside school. According to the RRI approach, this will facilitate the process of providing future researchers and innovators with tools, skills and qualifications that facilitate and ensure engagement with society and ethical working methods.

Widening Actors, Committing Stakeholders

An important achievement of the EC funded Science Education projects has been the progressive enlargement of the categories of actors involved, which should also lead to the comprehensive, responsible and passionate commitment of relevant societal stakeholders.

According to the Technopolis Report, future programmes, for the whole science-society area, should present "more active input and 'buy-in' from key actors" "such as national Science and Education Ministries" (Technopolis-Fraunhofer 2012). Similar consideration had already been expressed by the mid-term assessment of SaS activities: "the range of participants has not included many school authorities so far, and policy makers have not been the primary audience for most projects" (European Commission 2007c). The reasons for this are complex. Most projects have signalled their good intentions towards policymakers, and many have held national workshops or Brussels-based conferences with the express purpose of addressing/approaching policymakers. This post-hoc dissemination of policy recommendations suffers from the same problems as inquiry-based science education; namely, there is little opportunity to conduct research into the long-term effects of such actions.

In the field of science education, Ministries, public authorities and industries should strengthen their partnership with schools and research organisations and become morecommitted to the adoption, implementation and maintenance of at least some project achievements, including policy recommendations. Further research should improve understanding of how the growing involvement of societal actors will and can have an impact on policy making.

In order to achieve these aims, transversal project activities, strictly devoted to the relationship between researchers, policy makers and stakeholders, as well as to the implementation issues, could be required by the EC and could be equally developed by means of participatory methodologies.

Networking – One Way to Go Beyond Project Boundaries

In most successful FP7 projects, widening the range of actors involved and using networks have been crucial.

The creation of networks among teachers, researchers and various stakeholders has headed in the multiple directions of sharing tools and materials, proposing methodologies and mutual learning. The great effort that is going on among science education communities is to keep these networks active and meaningful beyond the projects' lifetime. However, this is difficult once project funding has finished.

Teachers are key players in the renewal of science education. Being part of a network allows them to improve the quality of their teaching and enhances their motivation. Networks can be an effective component of teachers' professional development, are able to stimulate learning and mutual learning, production and widespread use of teaching materials, teaching courses and dissemination of best practices, with particular added value if they can bring together various stakeholders. Moreover, teacher networks may be complementary to more traditional forms of in-service teacher training and are open to gain advantage from innovative platforms for interaction, education and participation. Further help can come from new media and social networks.

Not all teacher and professional networks have the same degree of pervasiveness, adoption and maintenance. One indicator of the effectiveness of the networking process is, therefore, its life beyond project boundaries.

In 2011, coordinators and members of several STEM projects, most of which were financed by the Science in Society programme, but also by other initiatives, such as the Lifelong Learning Programme, created the informal network ProCoNet. INSTEM, a Comenius network, grew out of ProCoNet and they currently work together in a knowledge exchange process on inquiry-based teaching and learning, whilst interacting with stakeholders.

Another example is SUSTAIN – Supporting Science Teaching Advancement through Inquiry, in which some institutions who participated in Science in Society on IBSE methodologies, joined together once more to develop a Comenius multilateral network to further exchange their experiences and build related knowledge.

In some cases, national networks have been able to stay live after the end of projects. An example is the network created in Italy following the KidsINNscience project, in which a national community of teachers' remains involved in IBSE experimentation and in knowledge exchange on science education theory and practice.

Impact Knot

SaS/SiS projects have been characterized by being highly interdisciplinary, involving research in several scientific fields and having declared complex social objectives. For all these reasons, "linear cause-and-effect relationships are difficult to make"(Technopolis-Fraunhofer 2012) and assessing impact is a hard task. This is particularly true for Science Education projects. Scientists, practitioners and policy-makers generally acknowledge the crucial role of education in society and, as we have seen, the economic and career arguments of science education are widely recognised.

All the same, many of the potential impacts become visible only after a rather long time-period. Only in the long run it is possible to see the effects of experimentation, as well asof the widespread use of new learning methodologies. Things are even more complex when dealing with the implementation of a new curriculum.[10] The decision to implement a new curriculum takes time, and after that a "whole cohort of students needs to be exposed to this new curriculum" (Technopolis-Fraunhofer 2012) before it is possible to evaluate how this process impacted education and society.

Although many studies have dealt with student assessment in science, most of which are mentioned in the Eurydice Report (Eurydice 2011), there is still lack of analysis and assessment of the implementation of science education methodologies. As seen before in this chapter, the downside of the great effort devoted to implementing inquiry based learning is that little formal research has been produced which evidences the effectiveness of this approach. The lack of robust research on the effects and results of IBL/IBSE, therefore, extends the problem of impact evaluation for science education projects.

Further considerations refer to positive and negative impact of research and to the possibility of defining 'right' outcomes and impacts of research and innovation (Von Schomberg 2013).

10 "Countries in Europe not only have different epistemic visions of science and science teaching, they also have different approaches to curricula: in many countries the curriculum is orientative and not prescriptive, so that while teachers seem relatively free to make choices and establish their own priorities, in the reality they follow the 'accepted practices', what their colleagues do, what text book proposes, what parents expect. Changes in an apparently free situation could be as difficult as in a top-down system, because they require changes in 'public opinion and of a 'critical mass' of teachers" (Duschl e Mayer).

One more point is the complexity of managing all intervening variables, which tends to inhibit concrete measurement of the causal impact of education on economic growth. Aghion and colleagues (Aghion et al. 2009) stated that "*some* investments in education raise growth", depending on many variables such as the type and place of interventions.[11]

With reference to the impact on policy of SaS/SiS projects, the Technopolis analysis came to the conclusion that while very many projects are, in a very general sense, foreseen to be of utility to policymakers or academics or the general public, there is not "any detailed understanding of, or connections to, the organizations that could benefit from the results and what it is that they might do differently based on the project outputs. As such, we have found that while most projects confidently expect to have an impact on policy, most also do not have a clear sense as to how this would actually take place"(Technopolis-Fraunhofer 2012).

In order to be able to effectively guarantee systematic impact assessments for future projects, some central aspects should be highlighted, including pursuing "a comprehensive (ex-ante) impact assessment" and elaborating the understanding of "the complex mechanisms leading to long-term impacts in complex environments" (Technopolis-Fraunhofer 2012).

Documents preparatory to RRI, therefore, stress the importance of "exploring impacts in advance"(Sutcliffe 2011), with reference to the variety of actors and processes involved in research and innovation[12].

11 "Massachusets, California or New Jersey might benefit more from an investment in Mississippi's research universities than Mississippi does" (Aghion et al. 2009)

12 I wish to thank Peter Gray for the fruitful discussion we had on science education

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Annex 1 – Main Projects in the Science Education Area

FP6 projects

For FP6, the projects of the following calls have been considered: *Science education in Europe*; *Science education and careers 2004*; *Science education and careers 2005*. Also projects related to the call *European science week initiative* have been considered as they include science education at school and young people and science issues.

Project Acronym	Project Title	Coordinator (Name Of The Organisation And Country)	Number of partners involved	Start Date	End Date	Duration	Total Cost (€)	Total Funding (€)	Contract Type**
CISCI	Cinema and Science	TECHNISCHE UNIVERSITAET WIEN, AUSTRIA	11	02-02-09	01-02-11	24	494411	462962	SSA
SCIENCEDUC	Renovation of science teaching in European primary education with inquiry methods	ECOLE NORMALE SUPERIEURE, FRANCE	5	02-11-08	01-11-11	36	375000	375000	CA
PENCIL	Permanent European resource centre for informal learning	MINISTRY OF PRESS AND MASS MEDIA, BELGIO	18	02-10-08	01-10-11	36	4444500	4444500	SSA
ESTI	EIROforum European science teachers initiative	EUROPEAN SPACE AGENCY, FR	6	02-11-08	01-11-12	48	3833526	2417490	SSA
ECFUN	European Children's Future University Network - www.universiYOU.net	UNIVERSITAET WIEN, AT	7	02-12-09	01-06-12	30	455300	455300	SSA
HANDS-ON BRAINS-ON	Hands-on science teaching: combining formal and informal science learning	TIEDEKESKUSSAEAETIOE, FI	11	02-12-09	01-12-11	24	690000	690000	SSA
PROMISE	Promotion of Migrants in Science Education	EUROPAEISCHES TRAININGS- UND FORSCHUNGSZENTRUM FUER MENSCHENRECHTE UND DEMOKRATIE, AT	6	02-10-09	01-10-11	24	453500	296000	SSA
ESCALATE	Enhancing SCience Appeal in Learning through Argumentative inTEraction	THE HEBREW UNIVERSITY OF JERUSALEM, IL	6	02-01-10	01-07-11	18	499944	499944	SSA
POLLEN	POLLEN: Seed cities for science, a community approach for a sustainable growth of science education in Europe	ECOLE NORMALE SUPERIEURE, FR	12	02-01-10	01-07-13	42	1750000	1750000	SSA
PLASCIGARDENS	Plant Science Gardens: Plant Science education for primary schools in European Botanic Gardens	UNIVERSITAET INNSBRUCK, AT	5	16-10-09	15-12-11	26	699528	699528	SSA
PHYSFUN	Physics is Fun	POMORSKA AKADEMIA PEDAGOGICZNA, PL	7	02-05-09	01-09-10	16	65750	65750	SSA
ROBERTA-EU	Roberta goes EU	FRAUNHOFER-GESELLSCHAFT ZUR FOERDERUNG DER ANGEWANDTEN FORSCHUNG E.V, DE	1	02-10-09	01-01-13	39	751275	632281	SSA
WASTEWATERRESOURCE	Play with water: Introducing ecological engineering to primary schools to increase interest and understanding of natural sciences	HOCHSCHULE WAEDENSWIL - HSW, CH	6	02-11-09	01-07-12	32	307160	264000	CA
GAPP	Gender awareness participation process: Differences in the choices of science careers	SCUOLA INTERNAZIONALE SUPERIORE DI STUDI AVANZATI, IT	6	02-01-11	01-01-13	24	808380	808380	SSA

EFSUPS	Exploring the ground - Fostering scientific understanding in primary schools	WISSENSCHAFTSLADEN BONN E.V., DE	5	02-11-10	01-11-12	24	226986	226986	SSA
POPBL	School science teaching by project orientation - Improving the transition to University and Labour Market for boys and girls	FACHHOCHSCHULE OLDENBURG/ OSTFRIESLAND/ WILHELMSHAVEN, DE	17	02-10-10	01-10-12	24	844962	844962	SSA
FORM-IT	Form - it "Take part in research"	OESTERREICHISCHES OEKOLOGIE-INSTITUT, AT	11	02-11-10	01-11-12	24	697930	697930	SSA
UPDATE	Understanding and providing a developmental approach to technology education	JYVAESKYLAEN YLIOPISTO, FI	16	02-12-10	01-12-13	36	919300	873700	SSA
MaterialsScience	University-school partnerships for the design and implementation of research-based ICT-enhanced modules on Material properties	PANEPISTIMIO KYPROU, CY	6	02-01-11	01-01-14	36	652300	652300	SSA
PARSEL	Popularity and relevance in science education for scientific literacy	LEIBNIZ-INSTITUT FUER DIE PAEDAGOGIK DER NATURWISSENSCHAFTEN AN DER UNIVERSITAET KIEL, DE	10	02-10-10	01-04-13	30	872864	872864	CA
SUPERLIFE	Superconductivity in everyday life	BUDAPESTI MUSZAKI ES GAZDASAGTUDOMANYI EGYETEM, HUNGARY	9	02-06-08	01-10-10	28	390000	390000	SSA
VENUS TRANSIT 2004	VENUS TRANSIT IN JUNE 2004: EXOPLANETS AND THE SIZE OF THE WORLD	EUROPEAN SOUTHERN OBSERVATORY - ESO EUROPEAN ORGANISATION FOR ASTRONOMICAL RESEARCH IN THE SOUTHERN HEMISPHERE, GERMANY	4	02-01-08	01-01-09	12	616000	480000	SSA
SCHOOL-FORESIGHT	Launching a Visionary Quest for the Intelligent School of Tomorrow on the basis of Relevant State-of-the-art Scientific and Technological Achievements	INTERNATIONAL ENVIRONMENT AND QUALITY SERVICES S.A, GRECE	7	02-01-08	01-11-08	10	291734	291734	SSA
SHIELD	Launching an Educational Scientific Journey on Natural Hazards and Disasters - Exploring Today's Achievements, Future Challenges & Expectations with Respect to Forecast, Prevention and Mitigation'	INTERNATIONAL ENVIRONMENT AND QUALITY SERVICES S.A, GRECE	5	02-01-08	01-11-08	10	234340	234340	SSA
WESPA	A Web portal for Energy and Semiconductors Public Awareness	ISTITUTO NAZIONALE PER LA FISICA DELLA MATERIA, ITALY	6	02-01-08	01-07-09	18	3000	3000	SSA
ESCIENTIAL	European Science Festival	ASSOCIAZIONE FESTIVAL DELLA SCIENZA, ITALY	9	02-06-08	01-06-09	12	461716	225201	SSA
EUROBOT	Coupe d'Europe de robotique 2003/2004'	VM GROUP SA, FR	1	02-11-07	01-12-08	13	232800	147800	SSA

***SSA: Specific Support Action; CA: Coordination action*

FP7 projects

For FP7, the projects of the areas included in *Young people and science* of the action line *Strengthening potentials, broadening horizons* have been considered. Some project related to the area *Gender dimension of science* and to the action line *Science and society communicate* have been considered as long as they include science education at school and young people and science issues.

Project Acronym	Project title	Coordinator (Name of The Organisation and Country)	Number of partners involved	Start Date	End Date	Duration	Total Cost	Total Funding	Contract Type***
HULDA	Hulda, the European arts and sciences sailing festival	ILHAN KOMAN KULTUR VE SANAT VAKFI, TURKEY	14	01-05-08	31-12-10	32	1011619	800000	CSA-CA
EUCUNET	European children's universities network	KINDERBURO UNIVERSITAT WIEN GMBH, AUSTRIA	6	01-03-08	28-02-10	24	666086	594568	CSA-CA
HIPST	History and philosophy in science teaching	DEUTSCHE GESELLSCHAFT FUR INTERNATIONALE ZUSAMMENARBEIT (GIZ) GMBH, GERMANY	11	01-02-08	31-07-10	30	1099237	998211	CSA-CA
CARBOSCHOOLS+	European network of regional projects for school partnerships on climate change research	MAX PLANCK GESELLSCHAFT ZUR FOERDERUNG DER WISSENSCHAFTEN E.V., GERMANY	10	01-01-08	31-12-10	36	1426197	981553	CSA-CA
YOSCIWEB	Young people and the images of science on websites	CONSEIL GENERAL DE L'ESSONNE, FRANCE	7	01-01-08	31-03-10	27	540171	489122	CSA-CA
COREFLECT	Digital support for inquiry, collaboration, and reflection on socio-scientific debates	CYPRUS UNIVERSITY OF TECHNOLOGY, CYPRUS	8	01-03-08	28-02-11	36	916260	768942	CSA-CA
MIND THE GAP	Mind the gap: learning, teaching, research and policy in inquiry-based science education	UNIVERSITETET I OSLO, NORWAY	9	01-04-08	31-03-10	24	875081	780276	CSA-CA
S-TEAM	Science teacher education advanced methods	NTNU - NORGES TEKNISK-NATURVITENSKAPELIGE UNIVERSITET, NORWAY	27	01-05-09	30-04-12	36	5240157	4699928	CSA-SA
FIBONACCI	The FIBONACCI Project - Large scale dissemination of inquiry based science and mathematics education	ECOLE NORMALE SUPERIEURE, FRANCE	27	01-01-10	28-02-13	38	5343519	4784597	CSA-SA
PRIMAS	Promoting inquiry in mathematics and science education across Europe	PÄDAGOGISCHE HOCHSCHULE FREIBURG, GERMANY	15	01-01-10	31-12-13	48	3309697	2996236	CSA-SA
KIDSINNSCIENCE	Innovation in Science Education - Turning Kids on to Science	ÃSTERREICHISCHES ÃKOLOGIE-INSTITUT, AUSTRIA	10	01-11-09	31-07-13	45	1233444	999224	CP-FP-SICA
ESTABLISH	European Science and Technology in Action Building Links with Industry, Schools and Home	DUBLIN CITY UNIVERSITY, IRELAND	17	01-01-10	31-12-13	48	3768462	3389648	CSA-SA
SED	Science Education for Diversity	THE UNIVERSITY OF EXETER, UNITED KINGDOM	6	01-01-10	31-12-12	36	1409821	999982	CP-FP-SICA

TRACES	Transformative Research Activities. Cultural diversities and Education in Science	UNIVERSITA DEGLI STUDI DI NAPOLI FEDERICO II., ITALY	6	01-07-10	30-06-12	24	1198000	996700	CP-FP-SICA
PATHWAY	The Pathway to Inquiry Based Science Teaching	UNIVERSITAET BAYREUTH, GERMANY	28	01-01-11	31-12-13	36	4143983	3378770	CSA-SA
SECURE	Science Education CUrriculum REsearch	THOMAS MORE KEMPEN VZW, BELGIUM	11	01-11-10	31-10-13	36	1817994	1498506	CP-FP
INQUIRE	INQUIRE- inquiry-based teacher training for a sustainable future	UNIVERSITAET INNSBRUCK, AUSTRIA	19	01-12-10	30-11-13	36	2622901	2234024	CSA-SA
PROFILES	Professional Reflection-Oriented Focus on Inquiry-based Learning and Education though Science*	FREIE UNIVERSITAET BERLIN, GERMANY	24	01-12-10	30-11-14	48	3825220	3447910	CSA-SA
SIS CATALYST	SiS Catalyst: Children as Change Agents for the future of Science in Society*	THE UNIVERSITY OF LIVERPOOL, UNITED KINGDOM	19	01-01-11	31-12-14	48	4560902	4090120	CSA-SA
PRI-SCI-NET	Networking Primary Science Educators as a means to provide training and professional development in Inquiry Based Teaching	OFFICE OF THE PRIME MINISTER, MALTA	17	01-09-11	31-08-14	36	3182780	2836624	CSA-SA
ECB/INGENIOUS	European Coordinating Body in Maths, Science and Technology Education (ECB)	EUN PARTNERSHIP AISBL, BELGIUM	29	01-02-11	31-01-14	36	8134000	3578912	CSA-SA
ENGINEER	brEaking New Ground IN the sciencE Education Realm	BLOOMFIELD SCIENCE MUSEUM JERUSALEM (BSMJ), ISRAEL	26	01-10-11	30-09-14	36	3151188	2795871	CSA-SA
SAILS	Strategies for Assessment of Inquiry Learning in Science*	DUBLIN CITY UNIVERSITY, IRELAND	14	01-01-12	31-12-15	48	4248429	3748689	CSA-SA
CREATIVELITTLESCIENT	Creative Little Scientists: Enabling Creativity through Science and Mathematics in Preschool and First Years of Primary Education	ELLINOGERMANIKI AGOGI SCHOLI PANAGEA SAVVA AE, GREECE	12	01-10-11	31-03-14	30	1989200	1491900	CP-FP
TEMI	Teaching Enquiry with Mysteries Incorporated*	QUEEN MARY UNIVERSITY OF LONDON, UNITED KINGDOM	14	01-02-13	31-07-16	42	3558127	3135919	CSA-SA
ASSIST-ME	Assess Inquiry in Science, Technology and Mathematics Education*	KOBENHAVNS UNIVERSITET, DENMARK	10	01-01-13	31-12-16	48	5350835	3971945	CP-FP
MASCIL	Mathematics and science for life*	PÄDAGOGISCHE HOCHSCHULE FREIBURG, GERMANY	18	01-01-13	31-12-16	48	3776921	3298170	CSA-SA
CHREACT	Chain Reaction: A Sustainable Approach to Inquiry Based Science Education*	SHEFFIELD HALLAM UNIVERSITY, UNITED KINGDOM	12	01-06-13	31-05-16	36	4040400	3601587	CSA-SA

SCIENTIX 2	Scientix 2* ****	EUN PARTNERSHIP AISBL, BELGIUM	1	01-01-13	31-12-15	36	6529484	6000000	CSA-SA
FASMED	Improving progress for lower achievers through Formative Assessment in Science and Mathematics Education*	UNIVERSITY OF NEWCASTLE UPON TYNE, UNITED KINGDOM	9	01-01-14	31-12-16	36	2478828	1918076	CP-FP
PARRISE	Promoting attainment of Responsible Research and Innovation in Science Education*	UNIVERSITEIT UTRECHT, NETHERLANDS	18	01-01-14	31-12-17	48	2899979	2498125	CSA-SA
ENGAGE	Equipping the Next Generation for Active Engagement in Science*	SHEFFIELD HALLAM UNIVERSITY, UNITED KINGDOM	14	01-01-14	31-12-16	36	2804226	2476238	CSA-SA
IRRESISTIBLE	Including Responsible Research and innovation in cutting Edge Science and Inquiry-based Science education to improve Teacher's Ability of Bridging Learning Environments*	RIJKSUNIVERSITEIT GRONINGEN, NETHERLANDS	14	01-11-13	31-10-16	36	2795284	2498840	CSA-SA
ARK OF INQUIRY	Ark of Inquiry: Inquiry Awards for Youth over Europe*	TARTU ULIKOOL, ESTONIA	13	01-03-14	28-02-18	48	2785392	2490519	CSA-SA
HELENA	Higher education leading to engineering and scientific careers	SIAULIU UNIVERSITETAS, LITHUANIA	7	01-04-09	30-09-11	30	1212390	930433	CP
IRIS	interests & recruitment in science. Factors influencing recruitment, retention and gender equity in science, technology and mathematics higher education	UNIVERSITETET I OSLO, NORWAY	6	01-05-09	30-04-12	36	1284514	999584	CP
MOTIVATION	Promoting positive images of SET in young people	BERGISCHE UNIVERSITAET WUPPERTAL, DEUTSCHLAND	7	01-01-08	31-12-09	24	536488	499888	CSA-CA
LIN10	60th Nobel Laureate Meeting at Lindau - Interdiscinplinarity, Internationalisation, and Excellence	STIFTUNG LINDAUER NOBELPREISTRAGER TREFFEN AM BODENSEE, GERMANY	1	01-05-10	30-04-11	12	2283000	55000	CSA-SA
SCICOM	European network of science centres in communicating energy-related topics	WELIOS BETRIEBS GMBH, AUSTRIA	11	01-04-08	31-07-11	40	1000927	894609	CSA-CA
ESCONET	ESConet trainers	UNIVERSITY COLLEGE LONDON, UNITED KINGDOM	1	01-01-09	31-07-11	31	609778	543827	CSA-SA
ACCENT	Action on climate change through engagement, networks and tools	FONDAZIONE IDIS-CITTÀ DELLA SCIENZA, ITALY	15	01-04-09	31-03-11	24	1348965	1017880	CSA-CA

MY SCIENCE	My science European program for young journalists	ACCADEMIA EUROPEA PER LA RICERCA APPLICATA ED IL PERFEZIONAMENTO PROFESSIONALE BOLZANO (ACCADEMIA EUROPEA BOLZANO), ITALY	3	01-01-09	30-06-10	18	279779	252612	CSA-SA

** Project under execution*

***CSA-SA: Support actions ; CSA-CA: Coordination (or networking) actions; CP: Collaborative project (generic); CP-FP: Small or medium-scale focused research project; CP-FP-SICA; Small/medium-scale focused research project for specific cooperation actions dedicated to international cooperation partner countries(SICA)*

***** Scientix 2 has been preceded by Scientix 1, RTD-L4-PP-2008-1, that put the basis for the portal development.*

Ethics

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1. EU strategy for Ethics in Science

As Helga Nowotny, president of the European Research Advisory Board, said science has become so pervasive, seemingly so central to the generation of wealth and well-being, that the production of knowledge has become, even more than in the past, a social activity, both highly distributed and radically reflexive. Science has had to come to terms with the consequences of its own success, both potentialities and limitations (Nowotny, Scott, and Gibbons 2001, 1).

In the wake of the innumerable recent developments in fields such as genetics, neuroscience, and new technologies, the ethical dimension of science in terms of its impact and its cost on daily life has come under the scrutiny of both public opinion and political bodies. Being rooted in society and increasingly in the world of politics, science can no longer be considered an independent place apart and has moved to the centre of debates in the developed world for over two decades.

Under existing European Union (EU) Treaties, there is no reference to ethics in research. However, ethical issues in research are addressed and EU's competences in the field derive from other legal sources: in several sectorial EU Regulations and Directives (patents, clinical trials, data protections, animal welfare, biosafety), in various Decisions on framework research programmes (i.e. FP6 and FP7 Framework programmes), in a variety of international treaties and protocols that have been incorporated into the EU legal order (Charter of fundamental Rights, Helsinki Declaration, Oviedo Convention). [13]

The EU has assumed a number of significant initiatives to promote responsible science and research which respect fundamental local, EU and international ethical principles:

1.1. Establishment of the European Group on Ethics in Science and New Technologies (EGE, 1998).

In November 1991, the European Commission (EC) decided to incorporate ethics into the decision making process for Community research and technological development policies by setting up the Group of Advisers on the Ethical Implications of Biotechnology (GAEIB). The Commission decided on 16 December 1997 to replace the GAEIB with the European Group on Ethics in Science and New Technologies (EGE), which acts as advisor to the president of the EC on issues of ethics and science, extending the Group's mandate to cover all areas of the application of science and technology. The Group released opinions during the period 2005-2014 which range from the ethical aspect of security and surveillance technologies to ethical aspects of animal cloning for food supply, from ethical aspects of nanomedicine to ethical aspects of ICT implants in the human body.[14]

13 The European Charter of Fundamental Rights is the cornerstone of EU's competence on research ethics. The principles of European research ethics are four: the principle of respect for human dignity, the principle of utility, the principle of precaution and the principle of justice (See *Concepts on Ethics,* 2008).

14 See, EGE's opinions, studies and general activity reports, http://ec.europa.eu/bepa/european-group-ethics/publications/opinions/index_en.htm (Accessed 15 August 2014).

1.2. Creation of an Ethical Review (ER) Institutional Platform for all Community Framework Research Proposals. [15]

The ER mechanism aims at introducing, at the outset, the ethical perspective into the working structure of a research consortium, safeguarding the compliance of EU research with ethical standards. Research proposals that have successfully passed the scientific evaluation are subject to an ethical evaluation. Through this, the public concerns relating to science are represented and addressed. The researchers have to consider the impact of their research, not only in terms of scientific advancement, but also in terms of human dignity and social and cultural impact. The most common ethical issues include the involvement of children, patients, vulnerable populations; the use of human embryonic stem cells; privacy and data protection issues; research on animals and non-human primates; the avoidance of any breach of research integrity (avoiding fabrication, falsification, plagiarism or other research misconduct); research involving developing countries; dual use. [16] The process is intended to ensure the protection of fundamental rights and the respect for ethical principles. Funds cannot be allocated to research that does not comply with the relevant EU and national legislation and the ethical considerations specified in the Framework Programme. All research projects that raise ethical issues will undergo an ethics review at EC level. Special attention is paid to research proposing interventions on human beings (such as surgical procedures or clinical trials), on other primates and research that is using human embryonic stem cells. Some areas are excluded from EU funding. These are human cloning for reproductive purposes, altering the genetic heritage of human beings, and creating human embryos only to conduct research or obtain stem cells. The ER mechanism provides legal guarantees to both research and human subjects; safeguards the social legitimacy and market/consumer acceptance of the eventual research findings; meets public concerns and international requirements; provides a predictable and well-structured regulatory research environment for all researchers applying in the frame of FP7 (Kritikos 2009). [17]

The Commission implements a thorough Ethics Review process for all proposals that raise ethical questions and are likely to receive Community funding. The process safeguards the protection of fundamental rights and the respect of ethical principles. It guarantees that no funding is allocated to research that does not comply with the relevant EU and national legislation and the ethical considerations specified in the Framework Programme.

The Ethics Review is the responsibility of the Ethics Sector of Directorate General for Research and Innovations, which also coordinates the methodological and implementation aspects of the Screening phase.

All proposals that are selected for funding and raise ethical issues undergo an Ethics Review by independent experts in research ethics coming from a variety of scientific disciplines. The Review is split in two phases: the Ethics Screening and the Ethics Review.

All FP7 funded projects can request specific assistance on ethics issues from the Ethics Review Helpdesk, accessible through the "get support function" of the CORDIS site.

Proposals that undergo an Ethics Screening and an Ethics Review can be flagged by the reviewers as requiring an Ethics Audit/Follow-Up. The objective of the Audit procedure is to assist researchers in dealing with the ethics issues that are raised by their work and if necessary to take corrective measures. During 2013 a number of Audits have taken place, regarding among others Security, hESC and Child Health Intervention Projects.

15 "All research activities carried out under the 7th Framework programme shall be carried out in compliance with fundamental ethical principles" (Decision 1982/2006/EC of the European Parliament and of the Council, Recital 30 and Article 6). The Ethics Review process is described in detail in the *Rules for submission of proposals, and the related evaluation, selection and award procedures*. The major change in FP7, compared to FP6, is that the ethics review is carried out on the proposal that is originally submitted with no additional information requested on ethical questions after scientific evaluation. The new *Rules* published on 22 March 2011 offer a detailed description of the new ER process, including the Ethics Screening and the Ethics Follow-up and Audit. See http://ec.europa.eu/research/participants/fp7documents/funding-guide/8_horizontal-issues/3_ethics_en.htm.

16 Dual-use items are goods, software and technology normally used for civilian purposes but which may have military applications.

17 Following the 2012 call for proposals, a *Mutual Learning and Mobilisation (MML)* action on Ethics was launched in 2013. The MML will bring together stakeholders in the ethics review procedure from across Europe (such as Research Ethics Committees, research associations etc.). The aim is to promote discussion and the development of approaches for the ethics review framework at the European level.

The Ethics Review Sector of DG RTD has organised a number of specialised workshops and focused training activities in order to facilitate the uptake of the ethics review procedures by all research related Commission and Executive agencies staff. The issues covered involve inter alia Research Ethics and Integrity, Innovation, Ethics Issues in Space and Security Research.

Under the aegis of the Ethics Review Sector of DG RTD, Guidance Notes have been prepared to serve as a support for those writing or reviewing research proposals, on Human Security in Research, Risk-Benefit Analyses and Ethical Issues, the Roles and Functions of Ethics Advisors/Ethics Advisory Boards in EC-funded Projects, on How to complete your ethics Self-Assessment and also on Data Protection and Privacy. These toolkits are valuable guidance documents for researchers, evaluators, Commission and Executive Agencies staff as well as anyone interested in the ethical issues in research.

1.3. Adoption of Action Plans and other policy initiatives for the promotion of responsible research and for linking scientific research closer to societal and ethical concerns and funding of research projects that examine the ethical standards in science and research.

EU and EC have funded a number of projects under Science and Society FP6 (SaS) and the Science in Society FP7 (SiS) on the relationship between ethics and science; the present work is devoted to their analysis.

In June 2001 Council of Ministers delivered a Resolution inviting the Member States and the EC to initiate a public dialogue on ethical issues in relation to science and new technologies at European level and to integrate ethics into research practices. The EC responded to this invitation by presenting in December 2001, the Science and Society Action Plan. The plan outlined the Commission's strategy for addressing the relationships between science and society and the harmonization of approaches. This was subsequently adopted in the SaS theme in the FP6 (2002-2006) and in specified 38 individual Actions. Six of these actions were specifically intended to demonstrate that responsible science is being placed firmly at the core of European policy making. In relation to Ethics the main goals were specified in Actions 29–34 as follows:

1. An information and documentation observatory will be developed to help track and analyse the development of ethical issues in science at national and international level (action 29);

2. An open dialogue will be established between NGOs, industry, the scientific community, religious and cultural groups, philosophical schools and other interested groups, stimulating an exchange of views and ideas on a range of critical issues, such as the ethical impact of new technologies on future generations, human dignity and integrity, 'info-ethics' and sustainability. A variety of mechanisms will be used (focus groups, polling exercises, debates, workshops or institutional forums etc.) (action 30);

3. Model courses and training modules will be developed in order to raise the awareness of researchers in the field of ethics (action 31);

4. Networks of ethics committees will be fostered at both national and local levels. The aim will be to achieve closer cooperation and a more effective exchange of experience and best practices (action 32);18

5. An international dialogue on ethical principles will be developed through a series of conferences and workshops. An important aim will be to build a capacity for ethical review in developing countries (action 33);

6. Networks of animal welfare committees will be fostered and training of young scientists on animal welfare issues will be promoted to support the implementation of European legislation on the protection of animals in research (action 34).

The mid-term evaluation of FP6 (2007, 39-40) found that progress had been made in implementing the FP6 action plan proposals, and made the following recommendations as regards to the area of ethics:

1. There is a strong need to foster cross-disciplinary dialogue in this field. Integrating ethical issues in a substantial manner in other strands of SaS as well as, more widely, in the FP needs to become a priority. There is, for instance, much to be gained from raising ethical issues in educational contexts.

2. Genetics, nanotechnology and, more generally, the cutting-edge technologies tend to dominate the ethical landscape of the SaS activities to the exclusion of other fields. There is a need to realign this focus so that it covers all areas of ethical novelty rather than concentrate on ethical issues in novel science disciplines.

18 The EC included in its Science and Society Action Plan the idea of a Forum of National Ethics Councils (NEC Forum), which was approved in December 2001. The NEC Forum is an independent, informal platform for the exchange of information and best practices on issues of common interest in the field of ethics and science. Each meeting included a joint session with the EGE which acts as advisor to the president of the EC on issues of ethics and science. NEC Forum membership comprises the chairpersons and secretaries of National Ethics Councils. The basis of the NEC Forum is the first meeting of the NEC Forum taking place in Athens, Greece in June 2003 at the initiative of the Greek Ethics Council.

3. There is little reflection demonstrated by the projects and other activities concerning the role of the private sector and commercialization. For instance, ethical implications of the commercial use of new technologies remain largely unexplored and could usefully be identified in future priorities.

4. There is a need to map existing practices in science-related ethics and also develop indicators to monitor its development in the future.

In 2007, in order to give effect to these recommendations, the DG-Research expanded SaS into the SiS programme (2007-2013) under the Specific Programme 'Capacities' in the FP7 for Research and Technological Development. The main aim of this was to encourage public engagement and meaningful dialogue between science and civil society.

Over the years new trends in research relating to ethical issues have emerged. The report of the project Monitoring Policy and Research Activities on Science in Society in Europe (Masis) (Siune et al. 2009) highlighted in the area of ethics the emergence of a new concept – responsible development and innovation – which presaged the 2011 SiS high-level objectives, Responsible Research and Innovation. Moreover it stressed the widening commitment amongst the very great majority of European research funders and research performers in regard to the need to actively govern science and the centrality of ethics within this. One may also add to these the growth in interest in framing codes of conduct for research (research integrity, misconduct) and managing ethical issues more formally and more explicitly (Technopolis group, Fraunhofer-ISI 2012a, 71).

Each of these trends has been taken into consideration in the 'Science with and for Society' (SwafS) programme which will be of great importance in facing the challenges tackled by Horizon 2020. This will require improving capacities and developing innovative ways of forming connections between science and society, adopting a new approach to research and innovation termed Responsible Research and Innovation (RRI). This approach sees ethical compliance as pivotal to the achievement of research excellence. The programme of work for the year 2014-2015 SwafS seeks to promote research integrity and to focus attention on the issue of ethics dumping. Owing to increased globalisation in research activities, there is the risk that European organisations may try to conduct ethically sensitive research outside EU borders in a way that might not meet ethical standards within Europe. In order to reduce the risk of this ethics dumping, EC promotes collaboration between European, national and international ethics bodies at all levels; additionally, it encourages the identification of good practices with a view to the development of a code of conduct for all actors.

Table 1 - Relevant Steps in the Field of Ethics and Science	
2000	Commission working document on Science, society and the citizen in Europe The Charter of Fundamental Rights of the European Union signed and proclaimed on 7 December 2000
2001	Council Resolution 26 June 2001 on Science and Society
2002	EC, Science and Society Action Plan
2002	Council Decision Adopting a specific programme for R&TD structuring the ERA
2006	Decision No 1982/2006/EC of the European Parliament and of the Council of 18 December 2006
2007	EC, Taking European Knowledge Society Seriously
2009	EC Research, The First MASIS Report.
2011	EC DG Research Workshop on RRI
2013	REGULATION (EU) No 1291/2013 of the European Parliament and of the Council of 11 December 2013 establishing Horizon 2020 - the Framework Programme for Research and Innovation (2014-2020) and REGULATION (EU) No 1290/2013 of the European Parliament and of the Council of 11 December 2013 laying down the rules of participation and dissemination in H2020.

2. A "Snapshot" of SaS and SiS Research Projects Dealing with Ethics in Science

Aiming at ensuring that the rapid progress of science is in harmony with fundamental ethical principles, SaS and SiS activities have promoted responsible research in Europe as well as the public dialogue, the monitoring and the early detection of ethical and social issues and risks arising from new technological developments for the benefit of policy makers and other interested groups.

These activities include: 1. networking between existing bodies that deal with ethics and activities in the field in Europe; 2. promoting dialogue on ethics in research with other regions in the global context; 3. awareness-raising and training activities in the field of ethics; 4. coordination and development of codes of conduct for research activities and technological developments; 5. research on ethics in relation to science, technology developments and their applications (nanotechnologies, human genetics, biomedical research, food technologies, etc.).

2.1. The Activities Carried out under FP6

Thirty-five projects were funded within the SaS programme under the Sixth Framework Programme, within four typologies: Integrated projects (1), Specific support actions (17), Coordination actions (8), Specific targeted research projects (9). The activities of the programme are in line with the main objectives as defined by the Action Plan, and all the activities have contributed to its implementation with the exception of Action 34. The projects follow the objectives and arrangements for FP6 and are devoted to the following priorities:

1. Capacity building to develop and update codes of conduct, tools and institutional capabilities (BIOTETHED, EDCEP, EDUBIOETHICS, ETHICSCHOOL, INES, SUMMERETHICS, TWR);

2. Networking to facilitate capability building through interaction and the harmonization and sharing of good practice (BIONET, CEC-WYZ, ENWISE ETHICS, EULABOR, FASTER, HEALTHRESEARCHETHICS, MONGOLETHICS, NEBRA);

3. Research to better understand ethical issues raised by emerging science and technology (BeSha, BITE, COB, DEPEEN, ENHANCE, ETHICSBOTS, from GMP to GBP, GENBENEFIT, IMGBCHIMERASHYBRIDIS, NANOBIO-RAISE, NANOCAP, REPROGENETICS);

4. Research to better understand new questions that may relate to the novel application of existing technologies as much as emerging fields (i.e. privacy and civil security) (EDIG, ETHICTRANSPLANTATION, ETHICALTRACEABILITY, EU-RECA, EUROBESE, GENEBANC, PRIVILEGED, PROPEUR).

The main achievements of the SaS programme relating to ethics were, inter alia (Papon et al. 2007,10; Rietschel et al. 2010, 45):

1. The programme has established a forum and a context at European level for examining Science and Society issues in a manner that provides reflective activities on specific issues related to scientific and technological research (such as Ethics).

2. Conferences and forums were able to launch debates in several areas at European level with a high level of participation from a diversity of actors. They have doubtless contributed to enhancing the visibility in Europe of important issues in areas such as ethics, women and science, and scientific communication, and have also provided pilot examples of methodologies to achieve this in a broader spectrum of issues.

3. The Science and Society projects supported a wide range of studies and participatory events in the ethics area. In the governance and ethics fields, SaS actions have led the European Commission to adopt a Code of Conduct for responsible nanoscience and nanotechnology research. It is worth mentioning also the 25 Recommendations on ethical, legal and social implications of genetic testing (SaS), which were intended to

function partly as "a 'code of conduct' for any actor in the field of genetic testing and partly as 'an action plan for genetic testing' to be implemented by policy-makers" (McNally et al. 2004, 6).

The mid-term assessment (2007, 39-40) lists the following recommendations:

1. The projects mainly focus on the most recent technologies, such as genetics, reprogenetics and nanotechnology. They should also investigate new ethical questions involved in a new application of an already routinely used technology. 19

2. As is common in Ethics research, the most crucial community to be reached are not the ethics researchers but the science researchers and science practitioners working in the corresponding fields. This needs to be taken into account in designing future activities.

3. In terms of the policy implications and potential impact of the funded activities in this area, there is also a need for an involvement of policy-makers and institutions that goes beyond the commitment to participate, towards a commitment to explore policy shifts in their practices.

4. There is little reflexivity demonstrated by the projects and other activities concerning the role of the private sector and commercialization. For instance, ethical implications of the commercial use of new technologies remain largely unexplored and could usefully be identified in future priorities.

2.2. *The Activities Carried out under FP7*

The slight rebranding of 'Science and Society' to 'Science in Society' in the seventh EU Framework Programme highlighted an increasing level of appreciation for the idea that the production of scientific knowledge is a social activity. The 2010 SiS Work Programme (WP) built on the foundations laid down in the 2009 WP, which sought to encourage more focused and structured actions that would have a greater European impact in order to promote a more effective critical mass of projects involving a wider range of key actors. The WP also encourages more focused work on ethics: 1. research on the role of ethics under EU policy and law at global level; and 2. investigation of ethics capacity building in research.

Approximately 30 FP7 projects fall in the area of ethics, equally divided between coordination and research activities. Within the ethics portfolio however research projects predominate compared to the overall SiS programme with the balance being closer to 3:1 in favour of coordination and support actions (Technopolis group, Fraunhofer-ISI 2012a, 71). The Commission has attempted to keep abreast of current issues with calls to develop support frameworks to address the growth in the number and importance of bio-banks within the general research landscape. The calls are also directed to examine possible implications of European research cooperation with third countries where there may be significant divergence from accepted EU good practices in terms of governance systems and ethical standards. While Mutual Learning and Mobilisation (MML) actions did not have a significant role, the 2012 Work Programme does call for MMLs in relation to RRI for synthetic biology, human enhancement and health and active ageing; one aspect of this work will require consideration of the ethical implications of new applications and therapies. The emphasis on ethics-related research and networking has been reduced in the latest WPs, probably because of the results already obtained.

The individual FP7 SiS WP include a wide range of ethics related topics under Action Line 1, "a more dynamic governance of the science and society relationship." The project portfolio is quite heterogeneous but can be classified in these areas:

19 For example, if genetic tests are used for insurance purposes or in gate keeping activities limiting access to sport or for a number of commercial purposes, this gives rise to new and specific ethical issues which go beyond those entailed in genetic testing itself (e.g. data protection and access to genetic information, a clash between commercial law and bioethics, discrimination and adverse selection). For some critical reflections on the exclusive focus on genetics see the *25 Recommendations on ethical, legal and social implications of genetic testing* (2004).

1. Networking or capacity building (ETHICSWEB, EURECNET, SET-DEV); 20

2. Research on ethics in science and technology. Several projects are devoted to research on privacy issues related to new technologies and applications, from biometrics for security to the Internet of Things (ETHICALPATS, PRACTIS, PRESCIENT);

3. Research into ethical implications of new applications or emerging technologies, such as synthetic biology (SYBHEL, SYNTH-ETHICS);

4. Ethical frameworks of new technologies (EFORTT, STEPE, TECHNOLIFE, VALUE ISOBARS); 4.1 Research underpinning policy support related to ethics precaution, and sustainable development (INNOVA-P2);

5. Ethics and new and emerging fields of science and technology (EGAIS, ETHENTECH);

6. Ethical issues of emerging ICT applications (ETICA, ICTethics, PHM-ETHICS);

7. Promoting trust and self-regulation in the scientific community, i.e. governance and ethics of the responsible development of nanosciences and nanotechnologies (NANOCODE);

8. Research on relationship between science, democracy and law (EPOCH, GEST);

9. Conditions for an informed debate on ethics and science, i.e. promotion of pan-European and international awareness of the ethical aspects of security technologies (HIDE, RISE).

10. Broader engagement to anticipate and clarify political, societal and ethical issues (NERRI, ASSET)

According to the Interim Evaluation within the area of research ethics the programme has been successful in forming improved networks of Research Ethics Committees. Central portals for the distribution of relevant materials and guidance have also been established. The programme has also made a contribution to developing and implementing ethics frameworks and review procedures across the EU and elsewhere. The development of new insights and practices in the areas of privacy and social impact assessment have also been supported by the programme (Technopolis Group, Fraunhofer-ISI 2012a, 122-123).

3. Best Practices

A project gains the status of best or promising practice when it is: measurable (i.e. its goals are clear and the progress toward them can be measured), notably successful (i.e. the method or programme not only yields good results, but makes more progress towards achieving its goals than most others with similar aims), replicable (i.e. the method or programme is structured and documented clearly enough so that it can be reproduced elsewhere).21

Keeping in mind these three qualities and the objectives of the Commission on the issue of ethics in science, the following best practices amongst all the funded projects under SiS-Programme in FP6 and FP7 were identified:

The ETHICSWEB project (FP7, area 1).

Inter-connected European information and documentation system for ethics and science: European ethics documentation centre.

20 Capacity building for ethics compliance was in FP7 a key objective for the Governance and Ethics unit.

21 See Community Tool Box, http://ctb.ku.edu/en/table-of-contents, Ch. 19, sect. 6: "Promoting the Adoption and Use of Best Practices" (Accessed: 15 August 2014)

Start date: 01/06/2008 End date: 31/08/2011 Total Funding: 896 321 € Contract type: CSA-CA - Coordination (or networking) actions.

Science is fraught with ethical concerns, and scientists need access to ethical information. The ETHICSWEB project worked to make this possible. It is essentially a large database, connecting disparate information sources via a single, easy-to-search (but sophisticated) multilingual interface. It currently includes 27 respected databases and about 500,000 records in total. It has become the world's largest provider of scientific ethics information. The purpose of the undertaking was to foster democratic debate in Europe. The ETHICSWEB's portal constitutes the project's focal point, and provides more than just a searchable database. It also offers a dynamic authoritative environment, a place for partners to coordinate their work via dedicated forums, and a safe repository for public and non-public documents.22

The PRESCIENT project (FP7, area 2).

Privacy and emerging fields of science and technology: Towards a common framework for privacy and ethical assessment.

Start date: 01/01/2010 End date: 31/03/2013 Total Funding: 998 227 € Contract type: CP-FP - Small or medium-scale focused research project.

The study team revisited the notion of privacy in the context of the social network revolution, and fed the results into discussions with the European Commission about new proposals for data protection. It has also broadened the model of Privacy Impact Assessment Frameworks (PIAs) to include ethical issues (Privacy and Ethical Impact Assessment, P+EIA), beyond data protection and privacy aspects. This broadened perspective is a major contribution to the establishment of a sound and updated working approach in view of the rapid development of the new social environment.23

The ETICA project (FP7, area 6).

Ethical issues of emerging ICT applications.

Start date: 01/04/2009 End date: 31/05/2011 Total Funding: 828 249 € Contract type: CP - Collaborative project (generic).

Researchers have identified emerging ICT applications and their potential areas of usage in order to analyse and evaluate their related ethical issues. This has been achieved particularly through wider stakeholders' engagement and consultation. By exploring technologies, ethical issues and current ways to address these, ETICA was able to develop two sets of recommendations: one for policymakers, and one for individuals and organisations involved in ICT research and development (R&D). In the future, implementing such recommendations will contribute to better and more ethically sensitive processes of ICT development across Europe. ETICA has significant impact, both academically and in terms of policy development. The project has essentially contributed to show how ethical issues of emerging technologies may be identified, and how in the process technology development is helped, especially at European level. This has been achieved in particular through wider stakeholder engagement and consultation, as seen from the collaborative ETICA/STOA Parliamentary Event in Brussels, as well as through the EU training event with personnel closely linked to ethics and ICTs. ETICA findings will support the European Group on Ethics in Science and Emerging Technologies in developing its Opinion on the Ethics of ICT. 24

22 For more details see "A database for ethics in science". http://cordis.europa.eu/result/brief/rcn/6303_en.html.

23 For more details see *A privacy and ethical impact assessment framework for emerging sciences and technologies. Final Report. Towards a common framework for privacy and ethical assessment*, Karlsruhe: Fraunhofer, Online Access: http://publica.fraunhofer.de/documents/N-238503.html.

24 For more details see the Final Report Summary - ETICA (Ethical Issues of Emerging ICT Applications) (http://cordis.europa.eu/result/report/rcn/56066_en.html).

4. Lessons Learnt and Some Open Challenges

The EU and the EC have done their best to promote ethics into life science and biotechnology research, to integrate it in the European Research Area (ERA), and to institutionalize it into the decision making process. They make significant efforts in promoting fundamental rights in research through the ethical review of research protocols, the funding of research on ethical issues raised by science and technology, and the promotion of pan-European and international dialogue on ethics. As a result of this intense activity some common European ethics standards have been launched in areas related to research ethics, and several codes of conduct, guidelines and recommendations have been delivered, which often have inspired national governments, private foundations and even scientific institutions outside Europe. The projects devoted to the issues of ethics and science funded under SaS and SiS programmes had among others the objective to specify what should be the ethical criteria to be applied to the research. The SaS and SiS programmes have contributed to increase awareness of the importance of ethics in the scientific community, and have given relevant guidelines to be applied directly to the projects funded by the Commission, as well as to be taken into account in the whole ERA.

Some lessons can be outlined from the projects funded under the SaS and SiS programmes25:

1. Success is dependent upon effective interconnections between the major stakeholders, including regulators, funders, research institutions, industry and representatives of civil society.

2. The field of Ethics has become an important domain where certain European standards have already evolved. However, it remains unclear whether research should involve the imposition of any kind of 'hard' legislation (such as EU Directives or Regulations) or should relate only to voluntary codes of conduct, standards etc.

3. While the greatest focus tends to be on newly developed technologies or newly identified risks, it is equally important that more attention be given to issues concerning the application of old technologies to new areas.

4. There are clear advantages to be acquired from increased efforts to share good practices internationally and to promote the diffusion, acceptance and widespread application of new standards, codes and practices.

5. In relation to policy implications and the potential impact of the funded activities in this area, it is clear that there is also a need for greater involvement from policy-makers and institutions which goes beyond the mere commitment to participation. An undertaking to explore policy shifts in their practices is also required.

6. Academia remains the main target group of many of the funded activities. This brings with it the risk that much of the expertise being developed remains within narrow circles.

7. In relation to privacy, it must be observed that the threats which the collection and processing of data creates for members of minority and dissenting social groups is not addressed, nor are the steps that will be taken to protect the rights, liberty and dignity of marginalised groups, vulnerable populations and minorities.

There is a need to extend the debate about ethics and research beyond the high profile areas of science and innovation (e.g. nanotechnologies, genetics, etc.) to include more mainstream areas such as environmental management, healthcare, social science research, etc. Additionally, our understanding of the problems raised by moral difference about the ethics of research both within and across national boundaries need to be investigated more in depth. The awareness of ethical issues among EU researchers and companies needs to be increased through embedding Ethical, Legal and Social Aspects (ELSA) as compulsory requirement in research and

25 See Technopolis group, Fraunhofer-ISI 2012b, 38-39.

development (e.g. product development). As Máire Geoghegan-Quinn argued:

European society is based on shared values. In order to adequately respond to societal challenges, research and innovation must respect fundamental rights and the highest ethical standards. Beyond the mandatory legal aspects, this aims to ensure increased societal relevance and acceptability of research and innovation outcomes. Ethics should not be perceived as a constraint to research and innovation, but rather as a way of ensuring high quality results (Máire Geoghegan-Quinn 2012).

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Annex 1- main projects in the Ethics area

FP6 Projects

Project Acronym	Project Title	Coordinator (name of organization and country)	Number of partners involved	Start Date	End Date	Duration (Months)	Total Cost (€)	Total Funding (€)	Contract Type
BIONET	Ethical governance of biological and biomedical Research: Chinese-European Co-operation	DE MONTFORT UNIVERSITY, UNITED KINGDOM	20	01-10-2006	30-09-2009	36	739129	739129	SSA
BIOTETHED	Biotechnology Ethics: deepening by research, broadening to future applications and new EU members, permeating education to young scientists.	UNIVERSITÀ DEGLI STUDI DI GENOVA, ITALY	16	01-09-2005	31-08-2008	36	980 600	980 600	CA
BITE	Biometric identification technology ethics promoting research and public debate on bioethical implications of emerging biometric identification technologies	CENTRE FOR SCIENCE, SOCIETY AND CITIZENSHIP, ITALY	9	01-10-2004	28-02-2007	29	290 000	290 000	SSA
COB	Challenges of biomedicine - socio-cultural contexts, European governance and bioethics	FELT, ULRIKE	9	01-04-2004	30-09-2007	36	716 438	716 438	STEP
DEEPEN	Deepening ethical engagement and participation in emerging Nanotechnologies	UNIVERSITY OF DURHAM, UNITED KINGDOM	4	01-10-2006	30-09-2009	36	1 026 325	894 226	STEP
EDCEP	European and Developing Countries Ethics Partnership	UNIVERSITETET I BERGEN, NORWAY	2	01-05-2004	30-04-2006	24	200 000	200 000	SSA
EDIG	Ethical dilemmas due to prenatal and genetic diagnostics interdisciplinary assessment of effects of prenatal and genetic diagnostics on couples in different European cultures	UNIVERSITÄT KASSEL, GERMANY	11	01-09-2005	31-10-2008	38	1 099 995	1 099 995	STEP
EDUBIOETHICS	Bioethical education on medical progress and human rights, in a multicultural, multidisciplinar and multireligious environment	UNIVERSITÉ RENÉ DESCARTES - PARIS 5, FRANCE	11	01-12-2006	31-08-2008	21	76 976	76 976	SSA
ENHANCE	Enhancing Human Capacities: Ethics, Regulation and European Policy	STICHTING VU-VUMC, NETHERLANDS	5	01-10-2005	31-03-2008	30	570 000	570 000	STEP
ENWISE ETHICS	Starting a Debate with Women scientists from Post- communist Countries on Ethical Issues	HUNGARIAN SCIENCE AND TECHNOLOGY FOUNDATION, HUNGARY	1	01-06-2003	31-08-2004	15	49 296	49 296	SSA
ETHICALTRACEABILITY	Ethical traceability and informed choice in food ethical issues	UNIVERSITY OF AARHUS, DENMARK	7	01-05-2004	30-04-2007	36	829 998	829 998	SSA

ETHICBOTS	Emerging Technoethics of Human Interaction with Communication, Bionic and Robotic Systems	UNIVERSITÀ DEGLI STUDI DI NAPOLI FEDERICO II, ITALY	10	01-11-2005	30-04-2008	30	436 112	420 000	CA
ETHICSCHOOL	Ethics of emerging Technologies	MALSCH TECHNOVALUATION, NETHERLANDS	4	01-09-2007	28-02-2009	18	168 371	168 371	SSA
ETHICTRANSPLANTATION	Organ transplantation: Ethical Legal and Psychological aspects. Towards a common European Policy 2007 Conference	ERASMUS UNIVERSITAIR MEDISCH CENTRUM, NETHERLANDS	1	01-08-2006	31-03-2008	20	170 538	170 538	SSA
EULABOR	Latin American and European systems of ethics regulation of biomedical research: comparative analysis of their pertinence and application for human subjects protection	INSTITUT NATIONAL DE LA SANTÉ ET DE LA RECHERCHE MÉDICALE, FRANCE	7	01-09-2005	31-05-2008	33	289 270	289 270	SSA
EUROBESE	Ethics and the Obestity and Overweight Epidemic: Image, Culture, Technologies and Interventions	ERASMUS UNIVERSITAIR MEDISCH CENTRUM, NETHERLANDS	8	01-12-2005	28-02-2009	39	799 999	799 999	STEP
FROM GMP TO GBP	Fostering bioethics practices (GBP) among the European biotechnology Industry	FRANCE BIOTECH, FRANCE	7	01-09-2006	28-02-2009	30	787 148	417 018	IP
HEALTHRESEARCHETHICS	Global Forum for Bioethics in Research	FRANCE BIOTECHFRANCE	8	01-11-2006	31-12-2008	26	252 400	250 000	SSA
IMGBCHIMERASHYBRIDS	Chimeras and Hybrids in comparative European and International Research - natural scientific, ethical, philosophical and legal aspects	UNIVERSITAET MANNHEIM, GERMANY	24	01-10-2005	30-11-2007	26	600 424	600 424	CA
INES	The Institutionalisation of Ethics in Science Policy; practices and impact	LANCASTER UNIVERSITY, UNITED KINGDOM	13	01-02-2004	31-08-2007	43	699 998	699 998	CA
MONGOLETHICS	Ethics in Mongolian and South-East Asian Science and Technology	UNIVERSITY OF CENTRAL LANCASHIRE, UNITED KINGDOM	1	01-12-2006	31-08-2007	9	53 160	53 160	SSA
NANOBIO-RAISE	Nanobiotechnology: Responsible Action on Issues in Society and Ethics	TECHNISCHE UNIVERSITEIT DELFT, NETHERLANDS	7	01-11-2005	31-10-2008	36	553 854	553 854	CA
NEBRA	Networking for ethics on biomedical research in africa	INSTITUT NATIONAL DE LA SANTE ET DE LA RECHECHE MEDICALE, FRANCE	8	03-01-2005	02-12-2006	23	380 000	380 000	SSA
PRIVILEGED	Determining the ethical and legal interests in privacy and data protection for research involving the use of genetic Databases and Bio-banks	UNIVERSITY OF SHEFFIELD, UNITED KINGDOM	3	01-01-2007	31-12-2009	36	738 270	738 270	CA
PROPEUR	Property regulation in European science, ethics and law	UNIVERSITY OF BIRMINGHAM, UNITED KINGDOM	11	01-02-2004	31-01-2007	36	780 000	780 000	CA

REPROGENETICS	Reprogenetics. The ethics of men making men	INTERNATIONAL FORUM FOR BIOPHILOSOPHY, BELGIUM	6	01-04-2004	31-03-2008	48	1 071 798	979 998	STEP
SUMMERETHICS	Copenhagen summer school in research ethics 2005	THE DANISH NATIONAL COMMITTEE FOR BIOMEDICAL RESEARCH ETHICS, DENMARK	1	01-05-2005	31-03-2006	11	27 291	23 291	SSA
TWR	Comparing emerging ethical issues and legal differences impacting on European clinical trials, including a training workshop for researchers in the New Member States.	MEDICAL ECONOMICS AND RESEARCH CENTRE, UNITED KINGDOM	1	01-09-2005	30-09-2006	13	75 461	75 461	SSA
FASTER	Feasibility study for an advanced systematic documentation, information and communication tool in the field of ethical issues in science, research and technology	FORTH-ICS, HELLAS	10	01-01-2004	30-09-2004	9	459 996	459 996	SSA
BESHA	Genomics and Benefit Sharing with Developing Countries	UNIVERSITY OF CENTRAL LANCASHIRE, UNITED KINGDOM	4	01-01-2004	31-12-2004	12	80 512	79 912	SSA
EU-RECA	European project on delimiting the research concept and research activities	THE UNIVERSITY OF MANCHESTER, UNITED KINGDOM	9	01-03-2004	31-05-2007	39	700 000	700 000	STEP
CEC-WYS	Central European Centre for Women and Youth in Science	INSTITUTE OF SOCIOLOGY OF THE ACADEMY OF SCIENCES OF THE CZECH REPUBLIC PUBLIC RESEARCH INSTITUTION, CZECH REPUBLIC	7	01-03-2004	28-02-2007	36	699 860	699 860	SSA
NANOCAP	Nanotechnology Capacity Building NGOs	IVAM, NETHERLANDS	16	01-09-2006	31-08-2009	36	1 306 180	EUR 1 306 180	CA
GENBENEFIT	Genomics and Benefit Sharing with Developing Countries - From Biodiversity to Human Genomics	UNIVERSITY OF CENTRAL LANCASHIRE, UNITED KINGDOM	6	01-09-2006	28-02-2010	42	548 639	548 639	STEP
GENEBANC	Genetic bio and dataBanking: Confidentiality and protection of data. Towards a European harmonisation and policy	KATHOLIEKE UNIVERSITEIT LEUVEN, BELGIUM	5	01-10-2006	30-09-2009	36	1 350 000	1 350 000	STEP

Source: Elaboration on CORDIS Open Data. Provisional list to be refined for the Stocktaking Final Report.

*** CA: Coordination action; IP: Integrated Project ; SSA: Specific Support Action; STEP: Specific Targeted Research Project;*

FP7 projects

Project Acronym	Project Title	Coordinator (name of the organizatin and country)	Number of partners involved	Start Date	End Date	Duration (Months)	Total Cost (€)	Total Funding (€)	Contract Type
STEPE	Sensitive technologies and European public ethics	LONDON SCHOOL OF ECONOMICS AND POLITICAL SCIENCE, United Kingdom	12	01-05-2008	31-12-2011	44	896216	689054	CP-FP
INNOVA-P2	(Pharma-innovation - patent-2)	UNIVERSITY OF CENTRAL LANCASHIREUnited Kingdom	7	01-06-2008	31-05-2011	36	930130	728640	CP-FP
EGAIS	The Ethical GovernAnce of emergIng technologieS New Governance Perspectives for Integrating Ethics into Technical Development Projects and Applications	UNIVERSITA CATTOLICA DEL SACRO CUORE, Italy	4	01-05-2009	29-02-2012	34	998 218	837685	CP
ETHENTECH	Ethics of enhancement technology	KUNGLIGA TEKNISKA HOEGSKOLAN, Sweden	4	01-07-2009	30-06-2012	36	667321	499889	CP
ETICA	Ethical issues of emerging ICT applications	DE MONTFORT UNIVERSITY, United Kingdom	11	01-04-2009	31-05-2011	26	1068773	828 249	CP
ICTethics	ICTethics. An interdisciplinary approach for addressing ethical, social and legal aspects of ICT	INTERNATIONAL FORUM FOR BIOPHILOSOPHY, Belgium	3	01-03-2009	29-02-2012	36	1228520	942540	CP
PHM-ETHICS	Personalized health monitoring (PHM)- Interdisciplinary research to analyse the relationship between ethics, law and psychosocial as well as medical sciences	ERNST-MORITZ-ARNDT-UNIVERSITÄT GREIFSWALD, Germany	6	01-07-2009	30-06-2012	36	1267351	998113	CP
SYBHEL	Synthetic biology for human health: Ethical and legal issues	UNIVERSITY OF BRISTOL, United Kingdom	4	01-10-2009	30-09-2012	36	1041045	803587	CP
SYNTH-ETHICS	Ethical and regulatory challenges raised by synthetic biology	TECHNISCHE UNIVERSITEIT DELFT, Netherlands	4	01-03-2009	31-08-2011	30	770608	531276	CP
TECHNOLIFE	a Transdisciplinary approach to the emerging challenges of novel technologies: Lifeworld and imaginaries in foresight and ethics	UNIVERSITETET I BERGEN, Norway	8	01-03-2009	30-11-2011	33	1049041	809343	CP
VALUE ISOBARS	The landscape and isobars of european values in relation to science and new technology	UNIVERSITETET I BERGEN, Norway	5	01-06-2009	30-11-2011	30	1085295	819971	CSA

SET-DEV	Science, ethics and technological responsibility in developing and emerging countries	CONSIGLIO NAZIONALE DELLE RICERCHE, Italy	10	01-03-2008	31-05-2011	39	1590047	1343477	CSA-CA
ETHICSWEB	Inter-connected European information and documentation system for ethics and science: European ethics documentation centre	RHEINISCHE FRIEDRICH-WILHELMS-UNIVERSITAET BONN, Germany	15	01-06-2008	31-08-2011	39	1004263	896321	CSA-CA
HIDE	Homeland security, biometric identification and personal detection ethics	CENTRE FOR SCIENCE, SOCIETY AND CITIZENSHIP, Italy	10	01-02-2008	31-01-2011	36	1244393	963762	CSA
ETHICAL	Promoting international debate on ethical implications of data collection, use and retention for biometric and medical applications	FRAUNHOFER-GESELLSCHAFT ZUR FOERDERUNG DER ANGEWANDTEN FORSCHUNG E.V, Germany	4	01-01-2009	31-12-2010	24	1080930	742394	CSA-CA
RISE	Rising pan-european and international awareness of biometrics and security ethics	CENTRE FOR SCIENCE, SOCIETY AND CITIZENSHIP, Italy	9	01-03-2009	29-02-2012	36	1253746	919501	CSA-CA
PRACTIS	Privacy - Appraising challenges to technologies and ethics	INTERDISCIPLINARY CENTER FOR TECHNOLOGICAL ANALYSIS AND FORECASTING, Israel	7	01-01-2010	31-03-2013	39	1267956	988456	CP-FP
PRESCIENT	Privacy and emerging fields of science and technology: Towards a common framework for privacy and ethical assessment	FRAUNHOFER-GESELLSCHAFT ZUR FOERDERUNG DER ANGEWANDTEN FORSCHUNG E.V, Germany	3	01-01-2010	31-03-2013	39	1261270	998227	CP-FP
EURECNET	European Research Ethics Committees' Network	RHEINISCHE FRIEDRICH-WILHELMS-UNIVERSITAET BONN, Germany	20	01-03-2011	28-02-2014	36	907 476	814 123	CSA-CA
GEST	Global Ethics in Science and Technology	UNIVERSITY OF CENTRAL LANCASHIRE, United Kingdom	4	01-02-2011	30-04-2014	39	892 295	696 820	CP-FP
EPOCH	Ethics in Public Policy Making: The Case of Human Enhancement	UNIVERSITY OF BRISTOL, United Kingdom	5	01-11-2010	31-10-2012	24	1477603	1150012	CP-FP
NANOCODE	A multistakeholder dialogue providing inputs to implement the European Code of Conduct for Nanosciences & Nanotechnologies (N&N) research	ASSOCIAZIONE ITALIANA PER LA RICERCA INDUSTRIALE - AIR, IItaly	9	01-01-2010	30-11-2011	23	1417801	1243777	CSA
PATS	Privacy awareness through security branding	TECHNISCHE UNIVERSITAT BERLIN, Germany	6	01-08-2009	31/03/2012	32	1080607	964594	CSA-SA
NERRI	Neuro-Enhancement: Responsible Research and Innovation	CIENCIA VIVA-AGENCIA NACIONAL PARA A CULTURA CIENTIFICA E TECNOLOGICA, Portugal	17	01-03-2013	29-02-2016	35	3783868	3312430	CSA-

ASSET	ACTION PLAN ON SIS RELATED ISSUES IN EPIDEMICS AND TOTAL PANDEMICS	VITAMIB SAS, France	01-01-2014	31-12-2017	36	4496454	3939880	CSA-SA

Source: Elaboration on CORDIS Open Data. Provisional list to be refined for the Stocktaking Final Report.

*** CP-FP: Small or medium-scale focused research project; CP: Collaborative project (generic); CSA-SA: Support actions; CP-FP - Small or medium-scale focused research project; CSA-CA: Coordination (or networking) actions;*

Open Access – Open Science

Carla Basili

Institute for Research on Firm and Growth CERIS, National Research Council CNR

1. EU Policy Landscape for Open Access to Improve Knowledge Diffusion

Alongside the long standing conviction that the free availability of academic results is the prerequisite for effective and efficient research, a novel awareness of the importance of scientific information for development has gained ground in the EC research policies, based on the conviction that in order to optimise the impact of publicly funded scientific research, it is important to improve not only the production of knowledge, but also access to and dissemination of the research results. This causal relationship forms the primary basis of a growing amount of policy positions and regulatory initiatives issued by the European Commission in the last recent years26.

In this context, Open Access has gained particular relevance and attention in the European Commission policy agenda, as a strategic means to improve the dissemination of results deriving from public funded scientific research.

Open access is a form of scholarly communication that - taking advantage of new improvements in electronic publishing and counteracting the continued increases in journal prices – constitutes an attractive alternative to commercial publishing models of scientific literature. The European voice in the Open Access arena is the Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities (October 2003)27 launched "to promote the Internet as a functional instrument for a global scientific knowledge base and human reflection and to specify measures which research policy makers, research institutions, funding agencies, libraries, archives and museums need to consider28". Yet, in the Berlin Declaration the concept of Open Access is not limited to the sole literature but is extended to "include original scientific research results, raw data and metadata, source materials, digital representations of pictorial and graphical materials and scholarly multimedia material. "29

The Commission endorses this definition, to include, in addition to publications, also research data and, in general, any form of research results. As to the EC actions to be supported, not only access to publications, but also preservation of scientific information and access to research data are the strands of action recommended.30

26 European Commission (2007) Communication on scientific information in the digital age. - Council conclusions of 22 November 2007 on scientific information in the digital age: access dissemination and preservation - European Commission. (2012). Towards better access to scientific information: Boosting the benefits of public investments in research. - High Level Expert Group on Scientific Data. (2010). Report to the European Commission. Riding the Wave: How Europe Can Gain From The Rising Tide of Scientific Data. - EESC (2013)– European Economic and Social Committee. Opinion of the European Economic and Social Committee on the 'Communication from the Commission — Towards better access to scientific information: Boosting the benefits of public investments in research' COM(2012) 401 final. (2013/C 76/09), Scientific data: Open Access to research results will boost Europe's innovation capacity (IP-12-790) just to mention a few.

27 The Berlin Declaration follows the Budapest Open Access Initiative (February 2002), which is an international effort to make research articles in all academic fields freely available on the Internet, and the Bethesda Statement on Open Access Publishing (June 2003), emanated by a set of 24 countries (US included). The Berlin Declaration was launched by a group of European research organizations and funding bodies, and counts to date more than 480 signatory institutions.

28 http://openaccess.mpg.de/Berlin-Declaration.

29 *ibidem*

30 As far as access to scientific publications is concerned, there are two publishing models:

— 'Gold' Open Access: payment of publication costs is shifted from readers (via subscriptions) to authors. These costs are usually borne by the university or research institute to which the researcher is affiliated, or by the funding agency supporting the research.

— 'Green' Open Access (self-archiving): the published article or the final peer-reviewed manuscript is archived by the researcher in an online repository before, after or alongside its publication. Access to this article is often delayed ('embargo period') at the request of the publisher so that subscribers retain an added benefit. EESC (2013)– EUROPEAN ECONOMIC AND SOCIAL COMMITTEE. Opinion of the European Economic and Social Committee on the 'Communication— Towards better access to scientific information: Boosting the benefits of public investments in research' COM(2012) 401 final. (2013/C 76/09), 14.3.2013

The institutional adherence of the European Commission to the Open Access strategy occurs in 2007, with the Council Conclusions on scientific information in the digital age, which, moving from the premise that "access to and dissemination of scientific information – publications and data – are crucial for the development of the European Research Area, and can help accelerate innovation" invite the Commission to experiment with Open Access to scientific results from projects funded by EU research framework programmes.31

2. EU Policy Milestones for Open Access

A detailed list of the European Commission policies on Open Access is given in Annex 1, while a set of selected policy milestones is highlighted in Table 1 below.

Table 1 - Selected EC policies for Open Access

Preparatory activities (2006)	Publication of EU-commissioned study on the economic and technical evolution of the scientific publication markets in Europe - Press release: Commission study addresses Europe's scientific publication system' - Public consultation 31 March to 15 June 2006
Institutional engagement with OA (2007)	Communication on Scientific information in the digital age: access, dissemination and preservation COM(2007) 56 final Council Conclusions on scientific information in the digital age: access, dissemination and preservation – recommendation to the Commission to experiment with Open Access to scientific results from projects funded by EU research framework programmes ERC (European Research Council) Scientific Council Guidelines for Open Access – which provide for the OBLIGATION to deposit in Open Access disciplinary or institutional repositories, within a maximum period of time defined by 6 or 12 months after the formal publication
Launch of Open Access Pilot in FP7 (2008	Launch of Open Access Pilot in FP7 in 7 research areas constituting the 20% of the total funding amount in FP7 – This initiative follows on from the ERC (European Research Council) Scientific Council Guidelines for Open Access and is formalised by the Commission Decision (C (2008 (C(2008) 4408). on the adoption and a modification of special clauses applicable to the model Grant Agreement of FP7
July 2012	Recommendation on access to and preservation of scientific information
July 2012	Recommendation on access to and preservation of scientific information
December 2013	Guidelines on Open Access to Scientific Publications and Research Data in Horizon 2020

3. European Union Strategy for Open Access in the Science and/in Society Programme Series from FP6 to FP7

According to the 2007 Council's solicitations, the European Commission sets out the principle that the Open Access perspective should systematically be taken into account in all Community policies for research. The actual implementation of this strategy consists in implementing Open Access to research results from projects funded by the EU Research Framework Programmes, namely FP7 and Horizon 2020.

31 Council of the European Union, Council Conclusions on scientific information in the digital age: access, dissemination and preservation. 2832nd Competitiveness (Internal market, Industry and Research) Council meeting Brussels, 22 and 23 November 2007.

<http://www.consilium.europa.eu/ueDocs/cms_Data/docs/pressData/en/intm/97236.pdf>

3.1 Sixth Framework Programme (2002-2006)

In FP6 there is no reference to the Open Access strategy in the Programme reference documents, however, the process of knowledge dissemination is regulated by the Regulation (EC) No 2321/200232 of the European Parliament and of the Council of 16 December 2002 concerning the rules for the participation of undertakings, research centres and universities in, and for the dissemination of research results for, the implementation of the European Community Sixth Framework Programme (2002-2006).

The Regulation (EC) No 2321/2002 provides some basic definitions for the terms "knowledge", " dissemination" and "use" and a set of rules for dissemination and use33 which will be adopted initially also by the FP7, before the changes to the model Grant Agreement of FP7 introduced with the launch of the Open Access pilot in FP7 ,as illustrated in the next section).

In the Science and Society action plan (2002) a section is devoted to the dissemination of scientific information, where the focus is on the communication between the research community and the general public. Therefore, the support is given to actions aimed at supporting independent sources of public information, developing thematic, multilingual scientific training modules for journalists. Furthermore, the establishment of a European scientific press agency is promoted.

3.2 Seventh Framework Programme (2007-2013)

With respect to the dissemination and use and access rights to scientific information, the goal in FP7 was to keep as much continuity as possible with FP6 with improvements/fine-tuning based on necessary changes that were identified during the implementation of FP634. The main changes identified at the initial stage of FP7 are: a) remove most of the obligations for participants to finalise conditions prior to their accession to the EC contract and b) remove most obligations to request prior approval from the Commission for publication, transfers of ownership and provision of access rights to third parties, where all other partners agree35.

In August 2008, a pivotal change in FP7 with respect to Open Access is the launch of Open Access Pilot in FP7 in 7 research areas constituting the 20% of the total funding amount in FP7. This initiative follows on from the ERC (European Research Council) Scientific Council Guidelines for Open Access and is formalised by the Commission Decision (C(2008) 4408) on the adoption and a modification of special clauses applicable to the model Grant Agreement of FP736 where it has appeared necessary to adopt six additional special clauses among which "the Open Access specific to 5 thematic areas37 as well as to the activities "Research Infrastructures"

32 http://cordis.europa.eu/documents/documentlibrary/66622801EN6.pdf

33 Article 23 - Use and dissemination of knowledge

1. The participants and the Community shall use or cause to be used the knowledge which they own arising from the direct actions or indirect actions, in accordance with the interests of the participants concerned. The participants shall set out the terms of use in a detailed and verifiable manner, in accordance with this Regulation and the contract.

2. If dissemination of the knowledge does not adversely affect its protection or use, the participants shall ensure that it is disseminated within a period laid down by the Community. Should the participants fail to do so, the Commission may disseminate the knowledge. Particular account shall be taken of the following factors:

(a) the need to safeguard intellectual property rights;

(b) the benefits of swift dissemination, for example in order to avoid duplication of research efforts and to create synergies between indirect actions;

(c) confidentiality;

(d) the legitimate interests of the participants.

34 http://ec.europa.eu/research/fp7/pdf/rules_explanatory_note_en.pdf

35 Cit.

36 C(2008) 4408 final, Brussels, 20.08.08

37 "Health", "Energy", "Environment (including Climate Change)", "Information & Communication Technologies" (Challenge 2), and "Socio-economic Sciences and the Humanities"

(e-infrastructures), and "Science in Society". Among The additional clause 39 states that "In addition to Article II.30.4, beneficiaries shall deposit an electronic copy of the published version or the final manuscript accepted for publication of a scientific publication relating to foreground published before or after the final report in an institutional or subject-based repository at the moment of publication. Beneficiaries are required to make their best efforts to ensure that this electronic copy becomes freely and electronically available to anyone through this repository: immediately if the scientific publication is published "Open Access", i.e. if an electronic version is also available free of charge via the publisher, or within X38 months of publication.39"

In addition, the revision of the FP7 Grant Agreement according to the Open Access Pilot implies the reimbursement of publication costs in Open Access ('paid' Open Access).

On December 2010, the official launch of the FP7 project OpenAIRE completes the implementation of the FP7 Open Access pilot.

Worth to notice that with the OA Pilot, Open Access takes on the status of a policy measure adopted by the European Commission itself, besides being merely a research topic supported financially.

In May 2011, the Commission sent a questionnaire to all project coordinators in order to collect feedback on their experiences of both the implementation of the Open Access pilot in FP7 and the reimbursement of Open Access publishing costs. Aim of the survey was to get meaningful input for Open Access policies in the next Framework Programme Horizon 2020.

4. EU Funded Research Projects on Open Access

The theme of Open Access, in its various branches, is a cross-cutting theme in European research projects, which has become mandatory as a result of the Guidelines for Open Access in Horizon2020 for each project financed with EU funds. However, it is possible to identify projects specifically focused on the general theme of the circulation of scientific information, in terms of Open Access to publications, to research data and research infrastructures, each with specific research perspectives (Annex 2 provides a list of these projects).

Under the FP6-Science and Society ((SaS-FP6) Programme no project has been funded that is specifically focused on Open Access.

The most relevant Open Access projects – OpenAire, OpenAirePlus and DRIVER - have been funded outside the Science in Society (SiS-FP7) Programme, specifically under the FP7-INFRASTRUCTURES funding scheme. This category of projects, in fact, provides the technological infrastructure enabling the deposition of peer-reviewed articles and the harvesting of their metadata (OpenAire), as well as the sharing of datasets of research data (OpenAirePlus) and the interface with the pan-European infrastructure for digital repositories (DRIVER).

Under the FP7 Science in Society Programme (SiS-FP7), within the larger goal of "Strengthening and improving the European science system", the theme of "Encouraging the debate on information dissemination, including access to scientific results and the future of scientific publications, taking also into account measures to improve access by the public" is one of the pillars of the Work Programme, and, along the whole duration of the SiS-FP7 (2007-2013) has resulted in actions, different from year to year, each addressing specific nodal aspects of the Open Access strategy, such as innovation in the scientific publishing system, problems associated with the diverse processes of access, dissemination, preservation and use of scientific data, just to mention a few.

More specifically, the projects NECOBELAC (Network of collaboration between Europe and Latin American Caribbean countries - Jan. 2009 – July 2012) and SOAP (Study of Open Access publishing - Mar. 2009 – Feb. 2011) have been funded as – respectively – coordination and support actions, under the topic "Coordination and

38 The number X will be 6 months in the thematic areas "Health", "Energy", "Environment (including Climate Change)", and "Information & communication technologies" (Challenge 2) and the activity "Research infrastructures" (e-infrastructures), and 12 months in the thematic area "Socio-economic Sciences and the Humanities" and the activity "Science in Society".

39 http://ec.europa.eu/research/press/2008/pdf/annex_1_new_clauses.pdf

support actions on the scientific publishing system in connection with research excellence and dissemination and sharing of knowledge" of the SiS-2008 Work Programme.

The project MEDOANET (Mediterranean Open Access Network - Dec. 2011 – Nov. 2013) is a support action funded under the topic "Reinforcing European strategies on access, dissemination and preservation of scientific information in the digital age" of the SiS-2011 Work Programme.

Under the SiS-2013 Work Package, two action lines for Open Access are identified by the Commission. The first one is "Upstream support to the definition, development and implementation of Open Access strategies and policies and to their coordination in the European Research Area", with two projects funded: RECODE (Policy RECommendations for Open Access to Research Data in Europe - Febr. 2013- Jan. 2015) and PASTEUR4OA (Open Access Policy Alignment STrategies for European Union Research - Febr- 2014 - July 2016)

The second SiS-2013 action line is " Downstream training on Open Access in the European Research Area" , with the project FOSTER (Facilitate Open Science Training For European Research - Febr. 2014- Jan. 2016) approved.

Further details on the above mentioned projects are provided in Annex 3

5. Concluding Remarks

New models of scholarly communication and new technological developments have been the major drivers towards the Open Access strategy, interpreted as a sustainable alternative to the commercial publishing system. As soon as the Open Access strategy moved from theory to experimentation, the EC reaction to these instances has been quite timely and strong, as it was not limited to provide funding for research projects on Open Access. The European Commission, in fact, in its role of research funding agency, set Open Access as a highly recommended issue (in FP7) and then as a requisite (in Horizon 2020) in the Framework Programme model Grant Agreement.

The legal basis of Open Access in Horizon 2020 are rooted in the official Regulations 1290/2013 and 1291/2013 - respectively, establishing Horizon 202040 and laying down the rules for participation - where Open Access, as already mentioned, is mandatory for all areas of the funding scheme, not limited, as it was in FP7, to only a part (20%) of the total FP7 budget.

On December 2013 the European Commission releases the Guidelines on Open Access to Scientific Publications and Research Data in Horizon 202041, where Open Access is recognised as the "core means to improve knowledge circulation and thus innovation in Europe."

In addition, according to an enlarged view of Open Access encompassing whatever form of scientific result – e.g. scientific data, research infrastructures, databases, prototypes, besides the traditional formal publications - the current trend in the EC strategy towards improving knowledge circulation is Open Science. Open Science, in fact, is among the intervention areas of the Horizon 2020 Work Plan 2014-2015 of the "Science with and for Society" programme.

In parallel, a first concrete step towards Open Science, is the recent launch of the Open Research Data Pilot, aimed at maximising access to and re-use of research data derived from research projects.

40 "(28) To increase the circulation and exploitation of knowledge, Open Access to scientific publications should be ensured. Furthermore, Open Access to research data resulting from publicly funded research under Horizon 2020 should be promoted, taking into account constraints pertaining to privacy, national security and intellectual property rights." - Article 18 *Open access*- 1. Open access to scientific publications resulting from publicly funded research under Horizon 2020 shall be ensured. It shall be implemented in accordance with Regulation (EU) No 1290/2013. - 2.Open access to research data resulting from publicly funded research under Horizon 2020 shall be promoted. It shall be implemented in accordance with Regulation (EU) No 1290/2013

41 http://ec.europa.eu/research/participants/data/ref/h2020/grants_manual/hi/oa_pilot/h2020-hi-oa-pilot-guide_en.pdf

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http://www.talentcentrebudapest.eu/sites/default/files/c_07620130314en.pdf

High Level Expert Group on Scientific Data. 2010. "Report to the European Commission. Riding the Wave: How Europe Can Gain From The Rising Tide of Scientific Data."
http://ec.europa.eu/information_society/newsroom/cf/newsletter-item-detail.cfm?item_id=6204

Annex 1 - EC Policy Initiatives for Open Access

March 2006	Publication of EU-commissioned study on the economic and technical evolution of the scientific publication markets in Europe - Press release: Commission study addresses Europe's scientific publication system' - Public consultation 31 March to 15 June 2006
December 2006	ERC (European Research Council) Scientific Council Statement on Open Access
December 2006	European Research Advisory Board (EURAB) final report, 'Scientific Publication: Policy on Open Access'
February 2007	Communication on Scientific information in the digital age: access, dissemination and preservation COM(2007) 56 final
September 2007	Consultation on Open Access question (No. 21) of Green Paper 'The European Research Area: New Perspectives' (ERA Green Paper)
November 2007	Council Conclusions on scientific information in the digital age: access, dissemination and preservation
December 2007	ERC (European Research Council) Scientific Council Guidelines for Open Access
July 2008	Open Access Handbook – joint publication by the European Commission and the German Commission for UNESCO.
August 2008	Launch of Open Access Pilot in FP7
2007 (revised June 2009)	Reimbursement of publication costs in FP7 ('paid' Open Access), see page 18, article II.16.4 'other activities'
June 2009	Results of questionnaire to Member States and associated countries via the Scientific and Technical Research Committee (CREST)
October 2009	'Working Together to Strengthen Research in Europe – European Research Area Conference', Brussels. Conclusions of session 1.5 'Open access and preservation: how can knowledge sharing be improved in the ERA?'
October 2010	High Level Expert Group on Scientific Data report to the European Commission 'Riding the Wave: How Europe Can Gain From The Rising Tide of Scientific Data'
November 2010	EC and National Experts Workshop Sharing knowledge: Open Access and preservation in Europe report
December 2010	Official launch of FP7 project OpenAIRE
February 2011	EC and FP7 Project Partners 'Open Access and preservation in the European Research Area: paving the way towards a sound strategy' report
May 2011	Public hearing on access to and preservation of scientific information:
July 2011	Launch of EC public consultation on scientific information (closes on 9 September 2011)
November 2011	Proposal for Open Access in Horizon 2020
December 2011	National Open Access and Preservation Policies in Europe
January 2012	Survey on Open Access in FP7
January 2012	Results of the public consultation on scientific information in the digital age
July 2012	Recommendation on access to and preservation of scientific information
July 2012	Communication Towards better access to scientific information. Boosting the benefits of public investments in research
July 2012	Communication on a reinforced European Research Area partnership for excellence and growth
October 2012	Frequently asked questions on Open Access to publications and data in Horizon 2020
2012	Survey of Open Access in FP7
January 2013	Favourable opinion of the European Economic and Social Committee on the Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions – Towards better access to scientific information. Boosting the benefits of public investments in research - COM(2012) 401 final
February 2013	The Competitiveness Council (Internal Market, Industry, Research and Space) met on 18 and 19 February 2013 in Brussels. In the field of research, the Council held a debate on Open Access to scientific information resulting from publicly funded research projects. Member States supported the idea of developing broader and more rapid access to scientific publications in order to help researchers and businesses to build on the findings of publicly funded research. Moreover, ministers welcomed the Commission's view that Open Access to scientific publications should be a general principle of the future Horizon 2020 research framework programme. The optimal circulation, access to and transfer of scientific knowledge is one of the objectives for the establishment of a genuine European Research Area.
July 2013	Public consultation on Open Research Data - On 2nd of July 2013, the EC held a one-day public consultation on open research data in Brussels to obtain the input of all concerned stakeholders on this important and sensitive issue.
October 2013	ERC (European Research Council) Scientific Council Guidelines for Open Access - revised
October 2013	Report of the European Commission - Public Consultation on Open Research Data
December 2013	Guidelines on Open Access to Scientific Publications and Research Data in Horizon 2020

Annex 2 - List of projects on Knowledge Diffusion Funded under FP6 and FP7

Project acronym	Project Title	Start year
RECODE	Policy RECommendations for Open Access to Research Data in Europe	2013
SERSCIDA	Support for Establishment of National/Regional Social Sciences Data Archives	2011
MEDOANET	Mediterranean Open Access Network	2011
OpenAIRE	Open Access Infrastructure for Research in Europe	2010
ODE	Opportunities for Data Exchange	2010
SISOB	An Observatorium for Science in Society based in Social Models	2010
APARSEN	Metadata for preservation, curation and interoperability)	2010
NECOBELAC	Network of Collaboration between Europe and Latin American-Caribbean Countries)	2009
SOAP	Study of Open Access Publishing by Key Stakeholders	2009
EUROCANCERCOMS	Establishing an Efficient Network for Cancer Communication in Europe	2009
BELIEF II	To Promote the Efficient and Effective Communication of Results, Networking and Knowledge among EU e-Infrastructure Projects and their Users	2009
ACUMEN	Academic Careers Understood through Measurement and Norms	2009
DRIVER II	Digital Repository Infrastructure Vision for European Research	2008
EUROVO-AIDA	Euro-VO Astronomical Infrastructure for Data Access	2008
LiquidPub	Liquid Publications: Scientific Publications meet the Web – Changing the Way Scientific Knowledge is Produced, Disseminated, Evaluated, and Consumed	2008
PARSE.Insight	Permanent Access to the Records of Science in Europe	2008
CLARIN	Common language resources and technology infrastructure	2008
CESSDA	Council of European Social Science Data Archives	2008
DARIAH	Digital Research Infrastructure for the Arts & Humanities	2008
OAPEN	Open Access Publishing in European Networks	2008
PEER	Pilot Programme Investigating the Effect of the Deposit of Author Manuscripts on the Ecology of European Research and Publishing	2008
COMMUNIA	Thematic Network on the Public Domain in the Digital Environment	2007
ELIXIR	European life science infrastructure for biological information	2007

Annex 3 - List of Projects funded under Open Science in FP7-SIS Programme

Project Acronym	Project Title	Coordinator (name of the organizatin and country)	Number of partners	Start Date	End Date	Duration (Months)	Total Cost (€)	Total Funding (€)	Contract Type
NECOBELAC	Network of collaboration between Europe and Latin American Caribbean countries to spread know-how in scientific writing and provide the best tools to exploit open access information in public health	ISTITUTO SUPERIORE DI SANITA' (ITALIA)	9	01/01/09	31/07/12	43	907177	800000	CA
SOAP	Study of Open Access Publishing	European Organization for Nuclear Research (Switzerland)	5	01/03/09	28/02/11	36	960945	809919	SA
MEDOANET	Mediterranean Open Access Network	National Documentation Centre/NHRF (Greece)	9	01/12/11	31/11/2013	24	964552	746695	SA
RECODE	Policy RECommendations for Open Access to Research Data in Europe	TRILATERAL RESEARCH & CONSULTING LLP – (UK)	8	01/02/13	30/01/15	24	1147484	949488	CA
PASTEUR4OA	Open Access Policy Alignment STrategies for European Union Research	ETHNIKO IDRYMA EREVNON (Greece)	15	01/02/14	31/07/16	30	2260335	1935940	CA
FOSTER	Facilitate Open Science Training For European Research	UNIVERSIDADE DO MINHO (PORTUGAL)	13	01/02/14	30/01/20165	24	1946905	1499860	CA

**** CA:Coordination (or networking) actions; SSA: Specific Support Action;**

Governance

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1. EU Strategy for Governance

The Science and Society Programme (SaS) under FP6 and the Science in Society Programme (SiS) under FP7 addressed the issue of governance from many perspectives, such as encouraging dialogue between scientists and other members of the public, improving the use of science in policy making, promoting an adherence to ethical standards, and developing better ways for the results of research to be accessed by all. The SiS Programme also supports specific research activities such as the connection between science, democracy and law, as well as governance issues linked to advanced participatory societies and to the ERA integration.

The interest for governance42 dates back to the Commission Working document on Science, society and the citizen in Europe (Commission 2000), which provided a preliminary definition, and outlined the governance should be an issue for the European Union to deal with because of the need to developing "an open mind to innovation", to acknowledging its risks and benefits, as well as to creating rules and instruments that favour an open dialogue between policy makers, researchers, citizens and stakeholders.

Definitions and perspectives were then refined in the White paper on the reform of the European Governance the Commission delivered in 2001 (EC 2001), which proposed opening up the policy-making process to get more people and organisations involved in shaping and delivering EU policy: "Reforming governance addresses the question of how the EU uses the powers given by its citizens. It is about how things could and should be done. The goal is to open up policy-making to make it more inclusive and accountable. A better use of powers should connect the EU more closely to its citizens and lead to more effective policies."

According to the aforementioned document, governance means "rules, processes and behaviour that affect the way in which powers are exercised at European level, particularly as regards openness, participation, accountability, effectiveness and coherence"; five requirements underpinning good governance were discussed together with the changes proposed: openness, participation, accountability, effectiveness and coherence, whose application is informed to the principles of proportionality and subsidiarity, thus shaping altogether the key reference points of the EU governance, which apply also for science .

The Council Resolution of June the 26th 2001 on Science and Society (European Council 2001) recalled, among others, the Commission's Working Document, and explicitly encouraged the Member States and the Commission to improve exchanges and dialogues, best practices and networking, developing common practices and guidelines on risk assessment and management and on the use of scientific advice for improving the EU governance.

In 2002 the Science and Society Action Plan was launched (EC 2002; CREST 2002); the actions related to the governance issue refer to:

Risk governance (enhancing risk identification, assessment, management and communication) in order to improve the consumer health and food safety, as well as to provide interfaces for better communication between scholars, managers and policy makers;

42 For analytical purposes, it is useful to recall here the distinction in EU policy between 'science for governance' and 'governance of science', which grounds on the usual distinction between 'science for policy' - the application of scientific advice for policy formation, and 'policy for science' - the formation of policy for the operation of the government science and innovation system, including funding allocation. The stocktaking refers to projects dealing with both the aspects of governance.

The use of expertise in policy making and in the public debate on hot topics of the agenda such as climate change or genetically modified organisms. The Plan outlined: a) the need to deepen problems related with the uncertainty of science that is unable to provide unique and non-controversial answers to social problems, b) the difficulties of policy makers for integrating scientific knowledge in the decision making contents, and c) involving stakeholders in debate on science and society non only for gaining trust from large part of the society, but also to deliver more robust policies.

The Action Plan went with other important steps:

a) The new ten-year Lisbon strategy launched in 2000, was aimed at making the Union "the most competitive and dynamic knowledge-based economy in the world", leading a growth ecologically, economically and socially sustainable. The mentioned development required a substantial investment in R&D and reforming processes, as well as the design of new participative modes of governance of science;

b) The Communication from the Commission on collection and use of expertise at all stages of EC policy making by implementing principles and guidelines (EC 2002) that sought to promote good practices related to the collection and use of expertise at all stages of Commission policy-making, with a view to establishing a sound knowledge base for better policies, and using expert advice in a credible way.

c) The adoption of a specific programme for R&TD for structuring the European Research Area (European Council 2002), whose realization should need a governance of science adapt to integrating different actors between European countries

In 2003 a Conference discussed the principles of the White paper on governance (EC 2004): the new ERA domain and the policy objective of integration let emerge the problem of how this domain can be governed democratically and equitably. The Conference identified the civil society, the research community and the European Commission as key stakeholders, and highlighted the need of changing attitude toward governance in order to create a policy framework adapt to the participatory process for the decision making of matters related to science and society.

The reactions to the White paper43 (EC 2003) confirmed the priorities, adding further issues to be considered for promoting a wider participation in EU policy shaping, and for improving the EU policy making. The participants in the public consultation judged the scope of the governance agenda proposed in the White Paper limited, because it focused predominantly on the effectiveness and efficiency of the decision-making system. Moreover, the consultation and involvement of civil society should not undercut the representative systems; the issues of bettering the involvement of the regional and local levels in both policy shaping and policy implementation have mainly drawn constituency comments which demonstrate interest, but generally call for clarification of the Commission's ideas; a demand for 'vertical subsidiarity' emerged from regional and local players.

Finally a precise statement on EU governance outlined that "the principles of good governance should not be equated to democratic government, as better governance cannot be the answer to a democratic deficit problem … the White Paper's call for inclusion of more players in the policy process, while necessary, does not by itself lead to increased democratic legitimacy of policies or institutions." (EC 2003). The set of comments collected in the Report also judged a commitment towards global governance was as extremely valuable, because of the global nature of problems affecting science and its relationships with society.

43 The comments were collected by the way of a public consultation that involved stakeholders, policy makers, civil society representatives, and researchers; the comments are summarized in EC, 2003.

Table 1- Relevant steps in the field of governance

2000	Commission working document on Science, society and the citizen in Europe
2001	EC, European Governance-A White Paper
2001	Council Resolution 26 June 2001 on Science and Society and on Women in Science
2002	EC, Science and Society Action Plan
2002	EC, Communication from the Commission on the collection and use of expertise
2002	Council Decision Adopting a specific programme for R&TD 'structuring the ERA
2003	EC, Report from the Commission on European governance (reactions to the White paper)
2006	EC, From science and society to science in society: Towards a framework for 'co-operative research
2007	EC, Taking European Knowledge Society Seriously
2008	Final Report on the Helsinki process on globalization and democracy
2009	EC, Global Governance of Science. Report of the Expert Group
2009	EC Research, The First MASIS Report.
2011	EC DG Research Workshop on RRI
2013	Horizon 2020 – Work Programme 2014-2015, 16 Science with and for Society

Source: author's elaboration

Based on the mentioned developments, in 2006 the FP7 introduced a conceptual change (from science and society to science in society). The aim was to embed scientific research in society, and to break down the barriers between science and society, and between scientists and citizens. The rationale was that the sustainable development of the European societies depends on their capacity to create and to exploit knowledge, and to innovate. This implied the concentration of research on governance under the SiS Action Line "A more dynamic governance of the science and society relationship" and a consistent growth of the funding allocated (see Section 2).

The same year, a Report of a European Commission Workshop (EC 2006) outlined the trade-off between public participation/public engagement rhetoric and the concrete attitude of high-level policy making: "Despite the high profile afforded to the language of 'involving stakeholders', 'public participation' and 'social inclusion', such perspectives serve to impede progress in achieving genuine public engagement as a pervasive feature of science governance. .... A constant pressure is exerted on those exercises that are undertaken, such that they are forestalled, or become diluted, diverted, constrained, or eventually neglected in the subsequent policy process.". (EC 2006) To face this challenge, the seminar outlined the need to promote public participation and engagement at the earliest stages of policy making, when the "policy developments remain relatively flexible and open to influence".

It is worth to mention other two initiatives that are relevant in order to understand the evolution of the EU strategy on Governance: the Report of the Expert Group on Science and Governance (EC 2007c), and the Final Report of the Helsinki process on globalization and democracy (Finnish Ministry of Foreign Affair 2007). The former recommended, among others, a shift from expert-dominated to more open deliberative science-informed institutions on ethics, risk and innovation, and "the adoption, both in the governance of science and the use of science for governance, of new institutions and procedures for more inclusive and pluralistic discussion, learning, and challenge".44

The latter, focusing on new requirements emerging from the process of globalization, highlighted global governance as a multi-actor and multi-level view of politics in which local, national, regional, and global political processes are inseparably linked, and in which different forms of governance co-exist side by side rather than in hierarchical order. Cooperation between stakeholders is the sole way for addressing the emerging challenges

44 The European Commission promoted since 2005, SINAPSE-Scientific Information and Expertise for Policy support in Europe, a web communication platform to promote better use of expertise in EU policymaking and governance. SINAPSE supports networking, expert groups, and facilitates ad-hoc public consultations and e-debates: http://ec.europa.eu/research/science-society/index.cfm?fuseaction=public.topic&id=1299&lang=1

(identifying public needs, facilitate negotiations, disseminate knowledge, broaden the public participation).

In 2009 the debate on science in society and on the governance issue and its global dimension was further enriched. The Report of the Expert Group on Global Governance of Science to the Science, Economy and Society Directorate of the EC (EC 2009a) discussed science as social institution producing knowledge oriented toward action, which needs global governance instruments, in order to be comprehensive of all sciences and crossing national boundaries. Efforts should be devoted to raise public participation, and to move toward models more adapt to govern the tensions between universal scientific knowledge, general ethic principles, and local knowledge and traditional values.

At the same time, the MASIS (Monitoring Policy and Research Activities on Science and Society) Expert Group set up by the European Commission produced the first Report (EC 2009b), which investigated the role of science and the relationships with society at the level of individual European countries. The evidences collected showed that self-regulation of science must go with instruments that can support the participation of other stakeholders. More social actors to be involved also means the need to broaden the coverage of policy for science, including more questions, not necessarily limited to traditional items such as funding and knowledge transfer. Concepts of accountability for performance, reflexivity through the assessment of results and impact, responsible development, responsible innovation, and 'ethicisation' gained a new prominence.

In 2011, a Workshop promoted by the DG Research to building by the way of a participatory process the notion of Responsible Research and Innovation in Europe (EC 2011), ended up with: a) the concepts of science for society, targeted to Europe's societal challenges and to the production of a right impact; 2) the concept of science with society, thus on responsiveness of research and innovation to society in the face of the uncertain effects that can be produced; and finally c) linking R&I to a general responsibility toward society, challenging scientists as well as other policy and economic actors about their role and responsibilities.

The mentioned thoughts and concerns, discussions and evidences collected and the results produced by the MASIS project (EC 2012), formed the basis for the construction of the new Horizon 2020 strategy and the related work programme.45

2. Snapshot of Science and Society and Science in Society

Providing a stocktaking on how the governance issues have been developed within the Science and Society action under FPVI, how they evolved under FPVII, and what lessons can be derived from the mentioned past experiences for the new phase of Horizons 2020, is not an easy task. Governance has several interconnected perspectives, which are suitable to be included, or excluded, from the field. Thus, the first issue for the stocktaking is to circumscribe the perimeter of the Governance issues under the Science and/in Society Programmes; for the aim of this Stocktaking Conference the governance section covers the following items:

Governance of policy, organizations and research activities: monitoring, design, implementation (practices, expert groups, structured debates supporting reform processes);

Use of scientific advice and expertise in policy making;

Responsible governance of the science, thus governance model and tools improving the possibilities of a successful engagement of citizens and society in a co-creative research and innovation process.

Governance mechanisms aimed at improving and consolidating the European Research Area, under institutional logics of collaboration, coordination and integration are included; issues related to research integrity and privacy are not included. The governance issue has some overlapping with other pillars, namely, public participation/

45 European Commission Decision C(2013)8631 of 10 December 2013, Annex 16 to the Decision, Horizon 2020 – Work Programme 2014-2015, 16 Science with and for Society.

awareness and ethic. This implies that the appreciation of the governance issue must be coordinated with the evidences of other thematic areas (first and foremost public engagement and ethic).

Annex 1 provides a provisional list of FP6 and FP7 projects covering the Governance issue, which will be refined and completed in the Final Stocktaking Report.

2.1 The Activities Carried out under FP6

Under FP6 11 projects dealing with governance issues were supported (8 Coordination Actions and 3 Specific support Actions).[46] The amount of funding was about 5,6 Million Euros. Almost all the partners involved came from western European countries.

One stream was the understanding of deliberative democracy methods on topics with a direct link to current policy discussions, to facilitate structured debates on controversial issues (stem cells, cloning, Genetic Modified Organisms, genetic property rights etc.). For instance citizens have been charged with assessing both research developments and ethical and socio-political aspects of issues at stake in the field of brain science and with delivering a set of recommendations relevant to policy-makers and the wider scientific and research communities. The initiative is supposed to help the agenda setting by linking specific issues of concern or interest to the public to a larger debate on brain science.

A second topic was the dimensions of risk communications and the extent to which the European countries have risk communications plans at the national level (e.g., natural risks and/or man-made, accidental risks and/or deliberate) and within specific risk domains (natural disasters, food safety, critical infrastructures, etc.). On the same issue, another objective was shaping a resilience and risk governance concept based on existing research, and an accompanying management tool.

Other perspectives put trust as fundamental for risk interpretation of the public between "real" and "perceived" risks, and focused how risk governance can be made transparent to decision makers and the general public. Limitations of risk science, the importance and difficulty of maintaining trust, and the socio-political nature of risk suggested a participative approach in order to make the decision process more democratic, to improve the relevance/quality of technical analysis and to increase the legitimacy and public acceptance of political decisions.

SaS projects produced different outputs, and a range of dissemination activities have been performed, as well as tools to conduct and facilitate deliberative consultations and monitor the change of attitudes among the European public (e.g. on contemporary Life Sciences). In some cases the projects evaluation reports provide a sound appreciation of diffusion of results and of their impact.[47] The Mid-Term Evaluation Assessment of SaS (EC, 2007b) outlined for scientific advice and governance activities, the excessive importance given to the topic of expanding public participation and the low attention to key questions on the democratic governance of technological change under conditions of globalisation, as well as the governmental scientific advisory process within the EC and its Member States.[48]

2.2 The Activities carried out under FP7

The new structure of FP7 produced a substantial increase of projects developed under the governance theme and an expansion of the topics: 25 projects were supported (3 Coordination Actions, 12 Specific support Actions, 10 Research projects, either Collaborative or small-medium scale). The amount of funding was about 32,8 Million

46 Provisional data -to be refined in the Final Stocktaking Report.

47 For instance DECIDE (Developing and Evaluating Communication Strategies to Support Informed Decisions and Practice Based on Evidence) materials have been translated in the languages of the countries where the meetings took place. A very diverse audience of more than 2000 adult and young citizens in several countries via the European network of science museums and other institutions has been engaged.

48 It is important to remind that under FP6 a large part of projects on governance were funded under the "Citizen and governance in a knowledge-based society" Priority Thematic Area.

Euros.49 16 projects have been completed, 9 projects are still under execution (expected to be completed in 2016).50 A broad coverage of countries involved is visible, from both Western and Eastern Europe, with the involvement of non-European countries in some cases.

One stream of projects concentrated on deliberative processes concerning human and environmental safety, ethical and moral dilemmas, and perceptions of risks and responsibilities as revealed through a focus on the market interfaces across the value chain of consumer goods. Consumers, citizens and their organisations could be the most important stakeholders in the diffusion process of products in Europe and beyond. The main goal is to evaluate and stimulate the deliberate dialogue, and give scientific support to the stakeholders responsible for this dialogue.

Improving the quality, effectiveness and efficiency of science advice (any recommendation for policy action based on scientific knowledge, considering also expert judgment, ethical and societal values, and experience from relevant stakeholders) for health across Europe was also included. Many EU Member States have national science advisory bodies, but they differ as to the structure, practices and relevance, which are difficult to be managed at national level. Moreover, many health issues have transnational dimensions. The rapid increase of scientific knowledge and health issues to be addressed exceed what national bodies can deal with.

A further topic was on tools and methods for the dialogue between government, science and society, which produced different theoretical and empirical models of the way in which science interact with society in their respective national realities, on assessment frameworks (e.g. the SIAMPI-Social Impact Assessment Methods for research and funding instruments through the study of Productive Interactions project), and the correlation between national and international research policies. Dialogue among multiple stakeholders on regulation and governance (scientific, institutional, industrial communities, the broad public) to articulate both consensus and absence of consensus, sustain a European debate between them, and foster the development of a shared frame of knowledge, objectives, actions were investigated, to defining constructive and practicable regulatory solutions.

Enabling effective two-way communication between scientists and other stakeholders is another object, which is supposed to enhance democratic debate with a more engaged and informed public, by providing better conditions for collective choices on scientific issues. Other approaches aimed at elaborating a model of Civil Society Organizations, representing relationships and causal effects of factors that influence participation in research, are on-going.

One relevant issue related to the governance tools, was the deepening of the concept description of the social impact of research, as the outcome of an iterative practice in which researchers and stakeholders each play a role. Productive interactions are exchanges between researchers and societal actors in collaborative settings (networks) in which knowledge is produced and valued that is at the same time scientifically and socially robust and relevant. On a similar topic a project is developing novel tools making possible to measure and predict the social appropriation of research knowledge, modelled as the product of complex interactions within and between multiple, intersecting communities of scientists, journalists, industrial, decision makers and consumers.

The discrepancy between the criteria used in performance assessment and the broader social and economic function of scientific and scholarly research, as well as a lack of recognition for new types of work that researchers need to perform was the object of the Academic Careers Understood through Measurement and Norms (ACUMEN) project, developing criteria and guidelines for Good Evaluation Practices.

The RIF project (Research and Innovation Futures 2030: from explorative to transformative scenarios) developed a two-stage interactive scenario process, which uses stocktaking of forward-looking activities, and

49 Provisional data to be refined in the Final Stocktaking Report

50 This analysis does not include SINAPSE (see footnote 3), a project funded under both FP6 and FP7, which is devoted to strengthen and improve the European Science system promoting exchanges and dissemination of results produced by other projects (e.g. MASIS, EUIMA -Sharing innovative practices in University modernization, and ULAB –European Laboratory for modelling the Technical Research University of Tomorrow). MASIS also is not included since it came from an EC initiative.

analysis of academic literature. The project pointed towards key critical junctures in ways of doing and organising research in universities, research organizations, companies and civil society, and the dynamics herein. This analysis was the basis to generate long-term transformative scenarios towards 2030 that incorporated significant structural and institutional changes in STI systems and practices.

Another focus was the analysis of the universities' modernization agenda, which addressed: i) the sustainability of university funding, financial management and development of full-costing, ii) the transparency and appropriateness of measurement tools for the assessment of university-based research reflecting the diversity of university missions, iii) the human resources development (careers). Moreover, mutual learning and best practices exchanges were at the core of a think-tank of five leading Technical and Research-intensive European Universities, committed to work together, towards renewing University policies in research, valorisation, entrepreneurship and outreach.

Under the Responsible Research and Innovation (RRI) topic, projects explored the dynamics of participation in research and innovation, the characteristics of responsible practices (nature of new partnerships among various stakeholders, researchers and policymakers that are developing within innovation networks), and the influence that these developments have on knowledge production and policy. A normative and comprehensive framework for RRI governance practices across and beyond Europe is under development. The framework will deliver cognitive and normative guidance that can be applied flexibly in different contexts.

The activities under SiS covered different fields, generally emerging interdisciplinary ones, such as GMOs, and Nanotechnologies, as well as key actors of the national and global research systems (funding organizations, universities and research organizations).

All in all, a large set of outcomes has been produced and others are foreseen; the academic outputs go with other results such as a broad dissemination of the project results: guidelines and policy recommendations for relevant stakeholders, tools, models and platforms for sharing data and information, disseminating them among stakeholders, including policy makers. A strong commitment in all the projects toward producing an impact in term of stakeholders' use of the results is visible.

3. Best Practices

Best practices are generally those that comparatively perform better than others for solving a specific problem, or treating a specific condition. A practice is a particular way of doing things. It may encompass a whole program, or a project, or it may simply refer to a single method; best practice can also promotes certain behaviours, attitudes, or causes. When science and society are concerned, the possibility to get such comparative assessment of practices often is neither robust nor reliable. The definition of best practices as techniques for getting the operational excellence (cost and time reduction, better quality and better outcomes), whose value rests on their success over time, the possibility to be replicable, and the capability to generate positive and measurable results, does not fit with the uncertainties and complexities that characterise both the scientific efforts and the society structure.

We then refer to 'best' practice as methodologies that have proven or promise to reliably lead to a desired result. As a consequence, considering projects that can be labelled as best practices in any field, implies looking at the knowledge and technology at one's disposal to improve the possibilities of being successful. Best practices are examples of robust research design, implementation and outcomes, not formal standards one is obliged to comply with.

Looking at projects funded under FP6 and FP7 Science and/in Society in the field of governance, we consider best practices those projects that have: a) a clear focus and a broad coverage of the governance issues which emerged in the policy debate as more relevant in the move toward the ERA; b) actual or foreseen achievements

and results which may be likely to be adapted to different contexts; c) dissemination activities and stakeholders involvement.[51] Hereafter three examples of projects (1 FP6 and 2 FP7) with the mentioned characteristics are briefly outlined.

RISK BRIDGE FP6

Building Robust, Integrative InterDisciplinary, Governance Models for Emerging and Existing risks

Start date: 01/07/2006 End date: 30/06/2009

Total Funding: 776.105 € Contract type: SSA - CA - Coordination action

This project (coordinator: TNO, The Netherlands) developed an integrative risk governance model connecting risk assessment - management and communication based on a resilience and discursive approach. For six risk field (Biotechnology/stem cells, Radioactive waste, Nanotechnology, Climate change, Sediments and Electromagnetic), a learning trajectory was organized, in which 3 workshops form the focal points (learning about best practices across disciplines and participants within each risk field; 'designs' a best science-policy interface for each risk field; compares, analyses and learns across risk fields resulting in an accepted governance model including trans-disciplinary lessons and input from scientists and policy makers). All the analyses are integrated in a report (book) recommending how to handle complex and emerging risks in the form of a process scheme approach. RISK BRIDGE is a good example of tool development for the risk governance that can be applied in several different contexts.

HEALTHGOVMATTERS FP7

Health Matters: A social science and ethnographic study of patient and professional involvement in the governance of converging technologies in Medicine

Start date: 01/06/2009 End date: 31/07/2012 Total Funding: 860.478 € Contract type: CP Collaborative Project (generic)

HEALTHGOVMATTERS, coordinated by the Zeppelin University GmbH, Germany, explored patients' and professionals' formal and informal involvement in governing the production and mediation of health and medical knowledge. The interest was in exploring interactions between constellations of actors (patients, care-givers, health professionals, citizens, and patient and professional organisations) who become involved in mediating and articulating the definitions and lived meanings of health, illness and disease in the context of encounters with new health technologies. Often referred to as "converging technologies", the integration of different actors in the area of medicine hold the potential to vastly improve ICT capacity for medical data management and information generation and to provide the foundation for the translation of research knowledge into clinical trials and clinical practice.

NANOCODE FP7

A multi-stakeholder dialogue providing inputs to implement the European Code of Conduct for Nano-sciences & Nanotechnologies (NS&N) research

Start date: 01/01/2010 **End date:** 30/11/2011 **Total Funding:** 1.243.777 € **Contract type:** CSA-SA Support Action

51 Conditions that enabled the mentioned projects to succeed are not discussed in the Background paper. This analysis will be eventually included in the Final Stocktaking Report.

The project objective was the definition and development of a framework enabling the successful integration and implementation at European level and beyond, of the Code of Conduct (CoC) for responsible NS&N research defined by the EC. AIRI (Italy) was the coordinator; the project was devoted to identifying and consulting stakeholders, to explore knowledge, attitudes, reactions and proposals in relation to the CoC assessing the most relevant codes of conducts, voluntary measures and practices for a responsible technology development. The project is one example of outcomes used to support the EC, EU policy makers and stakeholders in the implementation of the European CoC. The engagement of stakeholders in the debate improved the awareness on the CoC and in shaping its content to the stakeholders' needs and expectations, making it a more accepted, concrete and practical instrument for decision-making in NS&N R&D.

4. Lessons Learnt and Open Challenges

Governance is a key issue in the field of science in society. This clearly emerged both from the number of projects funded under SaS and SiS actions, the results of the MASIS Report, and the Interim evaluation and assessment of future options for SiS Actions (Technopolis et al. 2012). The movement from good governance to more elaborated concepts of democratic, participative, sustainable and responsible governance, is reflected in the aims, objectives, activities and outcomes of the projects funded under FP6 and FP7. Some lessons can be outlined.

Priority setting and decision-making. Two aspects emerged. The first is the importance of mechanisms for public involvement in science decision-making opening up the process to different stakeholders, and the use of the outcomes in the actual policy decisions. Differences emerged across countries between formalized procedures of participation and non-formalized ones, the former having kind of but low degree of public involvement, the latter no involvement. This is indeed a challenge to be take on board either when refer to top-down opportunities or bottom up ones (e.g. Civil Society Organizations).

The second aspect is the use of scientific advice in policy making, which is gaining room in European countries either through formalized or non-formalized procedures. Here a clear challenge is to develop ways to govern controversies especially in some research areas (e.g. GMOs, Climate change, Environment) where the scientific evidences are not so definitive, different suggestions for policy action might come from the scientists themselves, and putting in practice the precautionary principle in policy making might be extremely difficult.

Actor constellation. One important lesson coming from SiS is the acknowledgement and recognition of the broad range of actors, including research institutes, universities, funding agencies and firms, to be involved in the governance of science, and the different role they are likely to play shaping the relationship between science in society in a multi-level and multi-layered policy space such as R&I policy. It means that we are moving toward a sort of institutionalization of the actions in the field, which is likely to impact reform and restructuring processes, as well as the missions of the mentioned organizations. In this respect one key topic on the governance issue to be further explored is the changing positioning and involvement of the different actors in science and society.

Risk-based regulation became a core item within the governance issue. Awareness of 'innovation not as an end but as a mean' of economic wealth and social benefits went with the rise of the awareness of its transformative impact, which can be either for the good or for the bad. Both the linear model of science and innovation policy and the social contract for science are under discussion, and the public value of science is no longer taken for granted. How far this different perspective of innovation can go with the traditional policy approach of innovation as mean for economic growth to be achieved in short term?

The RRI concept has to be deepened and explored, understanding what it means in concrete terms for governance. RRI involves the need to make the motivations and the intentions for actions more democratic (science for society), considering what kind of transformation the decisions on science might produce on society, and whether these transformations are desirable. RRI also involves the institutionalization of mechanisms able

to explore the type of impact a decision of science might produce (science with society), with assessment and forward looking processes, anticipatory governance, accountability tools.

The way forward bring strong challenges for the governance issue: the documents analysed and the evidences collected converge considering the capability to deal with the new and uncertain topics must be sustained with a continuous and dedicated EU funding. This commitment fits with the principles of proportionality and subsidiarity of the EU funding, since no progress can be done without funding nor this funding can be actually find in the budgets of the EU Member States.

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Annex 1 - Main projects in the Governance Area

FP6 projects

Project Acronym	Project Title	Coordinator (name of the organizatin and country)	Number of partners involved	Start Date	End Date	Duration (Months)	Total Cost (€)	Total Funding (€)	Contract Type*
PATH	Participatory approaches in science and technology	MACAULAY INSTITUTE (UK)	7	01-04-2004	31-12-2006	33	254609	200000	CA
DECIDE	DEliberative CItizens' DEbates in European science centres and museums	AT-BRISTOL LIMITED (UK)	4	01-11-2004	30-/04-2006	18	330000	330000	SSA
CONFERENCE SACRIMM	European Conference on Scientific Advice, Crisis management and media	HELLENIC CENTER FOR INFECTIOUS DISEASES CONTROLL (GR)	1	27-03-2003	26-11-2003	8	140000	140000	SSA
CIPAST	Citizen Participation in Science and Technology	CITÉ DES SCIENCES ET DE L'INDUSTRIE (FR)	11	01-04-2005	31-03-2008	36	750000	750000	CA
ECD	Meeting of Minds. European Citizens' Deliberation on Brain Science'	KING BAUDOUIN FOUNDATION (BE)	11	01-11-2004	31-10-2006	24	1360352	800000	CA
STARC	STakeholders in Risk Communications	ELECTRICITÉ DE FRANCE (FR)	5	01-06-2005	30-11-2006	18	337491	337491	CA
SAFMAMS	Scientific Advice for Fisheries Management at Multiple Scales	AALBORG UNIVERSITY (DK)	7	15-04-2005	14-04-2008	36	690120	690120	SSA
RISKBRIDGE	Risk-BRidge (Building Robust, Integrative interDisciplinary, Governance Models for Emerging and Existing risks)	NEDERLANDSE ORGANISATIE VOOR TOEGEPAST NATUURWETENSCHAPPELIJK ONDERZOEK -TNO (NL)	5	01-07-2006	30-06-2009	36	776105	776105	CA
MIDIR	Multidimensional integrated risk governance	CONSIGLIO NAZIONALE DELLE RICERCHE (IT)	5	01-06-2006	29-02-2008	21	393857	367562	CA
CARGO	Comparison of approaches to risk governance	KARITA RESEARCH AB (SE)	4	01-06-2006	31-05-2008	24	356333	356333	CA
TRUSTNET-IN-ACTION	The making of inclusive risk governance: trustnet-in-action	MUTADIS CONSULTANTS SARL (FR)	14	01-01-2004	31-12-2006	36	799623	799623	CA

Source: CORDIS Open Data. Provisional list to be refined for the Stocktaking Final Report

**CA:Coordination Action; SSA: Specific Support Action*

FP7 projects

Project Acronym	Project Title	Coordinator (name of the organizatin and country)	Number of partners involved	Start Date	End Date	Duration (Months)	Total Cost (€)	Total Funding (€)	Contract Type*
MACOSPOL	Mapping controversies on science for politics	FONDATION NATIONALE DES SCIENCES POLITIQUES (FR)	7	01-01-2008	31-12-2009	24	1034315	924514	CSA-CA
MIRRORS	Monitoring ideas regarding research organizations and reasons in science	UNIVERSITA DEGLI STUDI DI CATANIA (IT)	-	01-01-2008	31-12-2009	24	312000	278000	CSA-SA
NANOPLAT	Development of a platform for deliberative processes on nanotechnology in the European consumer market	STATENS INSTITUTT FOR FORBRUKSFORSKNING (NO)	6	01-03-2008	31-08-2009	18	792810	599855	CSA-SA
FRAMINGNANO	International multi-stakeholder dialogue platform framing the responsible development of nanosciences and nanotechnologies (NS&T)	ASSOCIAZIONE ITALIANA PER LA RICERCA INDUSTRIALE (IT)	5	01-05-2008	31-03-2010	23	742934	675044	CSA-SA
DELIBPROCESSSCP	Identifying research needs and designing elements of deliberative processes on sustainable consumption and production in the demand areas food, housing and mobility	UNEP/WUPPERTAL INSTITUTE COLLABORATING CENTRE ON SUSTAINABLE CONSUMPTION AND PRODUCTION GGMBH-CSCP (DE)	2	01-02-2008	31-01-2010	24	399224	399224	CSA-SA
EUSANH-ISA	Improving science advice for health in Europe, EuSANH	HEALTH COUNCIL OF THE NETHERLANDS (NL)	5	01-02-2009	31-01-2012	36	1046940	943271	CSA-CA
SIAMPI	Social impact assessment methods for research and funding instruments through the study of productive interactions between science and society	KONINKLIJKE NEDERLANDSE AKADEMIE VAN WETENSCHAPPEN - KNAW (NL)	4	01-03-2009	28-02-2011	24	989744	793302	CP
EGAIS	The Ethical GovernAnce of emergIng technologieS New Governance Perspectives for Integrating Ethics into Technical Development Projects and Applications	UNIVERSITA CATTOLICA DEL SACRO CUORE (IT)	4	01-05-2009	29-02-2012	34	998218	837685	CP
HEALTHGOVMATTERS	Health Matters: A social science and ethnographic study of patient and professional involvement in the governance of converging technologies in Medicine	ZEPPELIN UNIVERSITAET GEMEINNUETZIGE GMBH (DE)	3	01-6-2009	31-07-2012	38	1049301	860478	CP

K-TRIANGLE	The Knowledge Triangle Shaping the Future of Europe	UTBILDNINGSDEPARTEMENTET (SE)	-	01-04-2009	31-01-2010	10	285813	150000	CSA-SA
NANOCODE	A multistakeholder dialogue providing inputs to implement the European Code of Conduct for Nanosciences & Nanotechnologies (N&N) research	ASSOCIAZIONE ITALIANA PER LA RICERCA INDUSTRIALE - AIRI (IT)	9	01-01-2010	30-11-2011	23	1417801	1243777	CSA-SA
EUIMA	Take-up activities by universities of specific guidelines and recommendations to implement their modernisation agenda	ASSOCIATION EUROPEENNE DE L'UNIVERSITE (BE)	-	01-01-2010	30-06-2012	30	1355235	1200000	CSA-SA
SISOB *	An Observatorium for Science in Society based in Social Models	UNIVERSIDAD DE MALAGA (ES)	7	01-01-2011	31-12-2013	36	1810212	1411858	CP-FP
ACUMEN*	Academic Careers Understood through Measurement and Norms	UNIVERSITEIT LEIDEN (NL)	9	01-03-2011	28-02-2014	36	2025828	1495412	CP-FP
ULAB	European Laboratory for modelling the Technical Research University of Tomorrow	UNIVERSIDAD POLITECNICA DE MADRID (ES)	4	01/01/2011	31/12/2012	24	699445	598063	CSA-SA
NANOETHICS 2011	Governance and ethics of nanosciences and nanotechnologies	POLISH ACADEMY OF SCIENCES (PL)	-	01-01-2011	29-02-2012	14	154900	107814	CSA-SA
PACITA*	Parliaments and Civil Society in Technology Assessment	FONDEN TEKNOLOGIRÅDET (DK)	15	01-04-2011	31-03-2015	48	5431938	4437730	CSA-SA
GAP2*	Bridging the gap between science, stakeholders and policy makers Phase 2:Integration of evidence-based knowledge and its application to science and management of fisheries and the marine environment	THE SECRETARY OF STATE FOR ENVIRONMENT, FOOD AND RURAL AFFAIRS (UK)	38	01-04-2011	31-03-2015	48	7555445	5913773	CSA-SA
RIF*	Research and Innovation Futures 2030: From explorative to transformative scenarios	AIT AUSTRIAN INSTITUTE OF TECHNOLOGY GMBH (AT)	4	01-10-2011	30-11-2013	26	1226201	860256	CSA-SA
CONSIDER*	Civil Society Organizations in Designing Research Governance	DE MONTFORT UNIVERSITY (UK)	7	01-02-2012	31-01-2015	36	1849467	1499381	CP-FP
GREAT*	Governance of REsponsible innovATion	UNIVERSITE DE NAMUR ASBL (BE)	9	01-02-2013	31-01-2016	36	2256080	1780571	CP-FP t
RES-AGORA*	Responsible Research and Innovation in a Distributed Anticipatory Governance Frame. A Constructive Socio-normative Approach	FRAUNHOFER-GESELLSCHAFT ZUR FOERDERUNG DER ANGEWANDTEN FORSCHUNG E.V (DE)	7	01-02-2013	31-01-2016	36	3708885	3003406	CP-FP

RESPONSIBILITY*	Global Model and Observatory for International Responsible Research and Innovation Coordination	FRAUNHOFER-GESELLSCHAFT ZUR FOERDERUNG DER ANGEWANDTEN FORSCHUNG E V (DE)	12	01-02-2013	31-01-2016	36	1779733	1484427	CSA-CA
TECHNOLIFE	A Transdisciplinary approach to the emerging challenges of novel technologies: Lifeworld and imaginaries in foresight and ethics	UNIVERSITY OF BERGEN (NO)	8	01-03-2009	30-11-2011	33	1049041	809343	CP
SYNTH-ETHICS	Ethical and regulatory challenges raised by synthetic biology	TECHNISCHE UNIVERSITEIT DELFT (NL)	4	01-03-2009	31-08-2011	30	770608	531276	CP

Source: CORDIS Open Data. Provisional list to be refined for the Stocktaking Final Report

*Under execution

**CSA-CA:Coordination (or networking) actions; CSA-SA: Support Action; CP-FP: Small or medium-scale focused research projec; CP: Collaborative Projet (generic)

Global Trends in Science in Society

Massimiano Bucchi and Brian Trench, with Ilaria Ampollini, Observa, Science in Society

1. Introduction

This report reviews global trends in 'science in society' practices and policies outside the EU. Relationships between science and society are receiving steadily increasing attention across the world, in academic, professional, policy-making and non-governmental sectors. This increased attention reflects the impacts scientific discoveries and science-related issues are having on society. Global health challenges, pandemics, climate change, energy choices, misuse of drugs in sport and environmental management are just some of the contexts in which science and scientists are thrust into the centre of public affairs. Further, the increasing weight of knowledge production and knowledge workers in both developing and developed economies makes the resourcing and governance of science central public policy questions. The scientific and technical skills capacity of countries and the associated issues of recruitment of young people into science are matters of concern across the globe.

'Science in society' as an area of professional practice, of research and of policy-making addresses these and other dimensions of the complex relationships between science and society. The European Union has had dedicated programmes of action and research on science in society for two decades. These have focused on questions of communication, public engagement and public understanding, but also on young people's career and study choices, gender equality and ethics in research. The broader agenda is captured in the current key phrase, responsible research and innovation.

The brief for this report was to examine trends in countries and regions outside the EU. Indeed, many of the countries and regions surveyed translate the broader topic of science in society largely in terms of science communication and public understanding of science.

Also, in several countries, government programmes and policies on science (sometimes expressed as 'science and technology', or 'science, technology and innovation') refer with varying degrees of emphasis and explicitness to the public's views of science and technology as a potential constraint on, or support for, economic and social development. Typically, this leads to government programmes for raising public awareness about science; these can incorporate direct or indirect support for establishment of science centres and museums, for national 'science weeks' or similar concentrated efforts in public science, for media attention to science, and for innovations in science education.

These dimensions of science in society, as they are represented in non-EU countries and regions, are our main concern in this report. In the relatively short time that 'science communication' has been a recognised term for a cluster of professional and educational practices, it has become a global phenomenon. When the first large-scale international conferences of science communication practitioners, educators and researchers took place in the early 1990s, their attention and attendance were largely restricted to western Europe and north America. But the PCST (Public Communication of Science and Technology) series of conferences now attracts 500-600 participants from 50-60 countries in all continents, alternating its venues between Europe and elsewhere. The 2014 PCST conference took place in Brazil, with very strong representation from that country and from Latin America. Previous conferences since 2000 have been held in India, South Korea, South Africa, again with strong local and regional flavours.

The World Conference of Science Journalists had 700-plus participants from 73 countries at its conference in Helsinki in 2013. The biennial conference is the principal activity of the World Federation of Science Journalists, though it also has programmes aimed at supporting science journalism in developing countries. The federation has affiliated associations in several countries of East and West Africa, as well as across the developed world.

The professional conferences of science museums and centres attract similar numbers and distributions of participants. The 2014 Science Centre World Summit in Belgium had 464 participants from 58 countries. That meeting followed conferences in 2008 and 2011, under slightly different names, that took place in Toronto and Cape Town, respectively. The meeting in 2014 attracted representatives from several international and inter-governmental bodies, including the International Council of Science (ICSU), UNESCO and CERN. Even an explicitly European-centred event, the annual meeting of ECSITE (European Network of Science Centres and Museums) assembled just short of 1,000 participants from 48 countries, many of them outside Europe, at its May 2014 event in the Netherlands.

The proliferation of science communication activities and institutions across the globe, but also the differences and similarities between countries and regions in the organisation of these activities and institutions have become an object of specific interest in the worldwide science communication communities. A collection of country profiles and essays, Science Communication in the World (Schiele et al 2012), that grew out of the PCST conferences featured 31 contributors from six continents, presenting national overviews side-by-side. Another edited volume (Bauer et al 2011) sketched a global view of patterns of scientific culture, drawing on national and international surveys of public attitudes to science and technology. Indeed, the spread of public opinion surveys focused on science and technology and the changing forms and content of those surveys are another aspect of the global spread of science communication and of its research.

In considering science communication comparatively across countries, we are helped by a large-scale assessment of science-in-society practices in Europe, the MASIS (Monitoring Policy and Research Activities on Science in Society) project which surveyed 37 countries. The project's final report categorised national science communication cultures as "consolidated", "developing" or "fragile", according to six parameters which appear valid beyond Europe (Mejlgaard et al 2012: 67). These refer to the science communication infrastructure; the political attention to science communication; the actors involved in science communication; the academic tradition of research dissemination; public attitudes towards science; the number and qualifications of science journalists.

Generally based on these criteria we review current and recent trends in science communication outside Europe in terms principally of the roles of various institutions in supporting science communication or, in other words, promoting the presence of science in society. The ways in which this is done varies between countries and within countries over time, as seen in the relative emphasis on public understanding (favouring promotional and/or didactic approaches) and on public engagement (favouring dialogical and interactive approaches). First, however, we offer: a brief overview of EU funded projects (mostly funded within the context of FP7- Science in Society) with a relevant international focus and involvement of participants outside the EU; a summary view of the interests of science communication practitioners and researchers from outside Europe through an analysis of their contributions to international science communication conferences.

2. Science in Society: International Collaboration Through EU Projects

International collaboration in the area of Science and Society (SaS)/Science in Society (SiS) has been strongly promoted within and beyond the EU through the European Commission's framework programmes of research, as well as by other means. From FP6 to FP7 the number of projects in this area with non-EU participants increased from 17 to 60, and the geographical coverage and themes broadened (see Fig. 1)[52]

52 See also the document of December 2012, Interim evaluation & assessment of future options for Science in Society Actions.

Themes covered in international collaborations beyond the EU member states within FP6 have included: scientific research; social aspects, coordination and cooperation; research ethics; education and training; policies; legislation and regulations; information and media. Themes covered in the context of international collaborations beyond the EU member states within FP7 have included: scientific research; social aspects, coordination and cooperation; innovation, technology and transfer; research ethics; education and training; regional development; policies; legislation and regulations; nanotechnology and nanoscience; security; standards; sustainability; employment. The changes in themes from FP6 to FP7 may also reflect the content of the programmes and of the specific calls within those programmes.

As shown in Fig. 1, external collaboration has expanded to new themes such as innovation, regional development, sustainability, standards, security. Other thematic areas display a relevant increase of international focus (coordination, education/training, research ethics). However, other themes have remained substantially excluded from such collaboration patterns. In particular, the absence of the theme of evaluation should be noted, particularly since the lack of attention and emphasis of evaluation has been repeatedly underlined by experts as one of the critical points for science in communication and science in society during the past years. It will be seen in the following section of this report that evaluation is a well-represented topic in international conferences of science communication practitioners and researchers. Several initiatives in this area (festivals, exhibitions, contexts, researchers' nights, conferences) lack thorough impact and evaluation analyses, mostly limiting themselves to (sometimes doubtful) counting the number of participants[53].

General objectives pursued by SaS/SiS FP6/FP7 projects involving external collaboration have included:

- Networking platforms and International databases
- Promotion of a global debate
- Reaching of multiple targets
- Sharing of knowledge
- Development of innovative practices
- Exploration of the ethical dimension of research
- Establishment of platforms for International dialogue
- Workshops
- Dialogue with policy-makers

Specific objectives have included:

- Environmental control (compilation of Atlas of Environmental Justice)

- Network on responsible research and innovation

- Exploration of ethics in S&T and the related policies

- Analysis of gap between science education research and actual teaching practice

- Analysis of technology used for teaching

- Promotion of gender equality

53 See Bucchi and Trench (2014); Jensen and Buckley (2014).

- Promotion of sustainability sciences and sustainability policies

- Exploration of benefits and risks of Synthetic biology

- Evaluation of ethics in biomedical research

- Sharing genomics research with developing countries

Summing up, it seems that international collaboration as reflected in EU funded Science in Society projects has increased, particularly regarding certain thematic areas. However, more substantial collaboration remains to be developed, particularly with regard to methodology and impact evaluation in Science in Society. However, this has to take into account the fact that "Science in Society" meanings and related policy strategies are interpreted and articulated in rather different ways in different areas of the world (see below, in particular chapter 8).

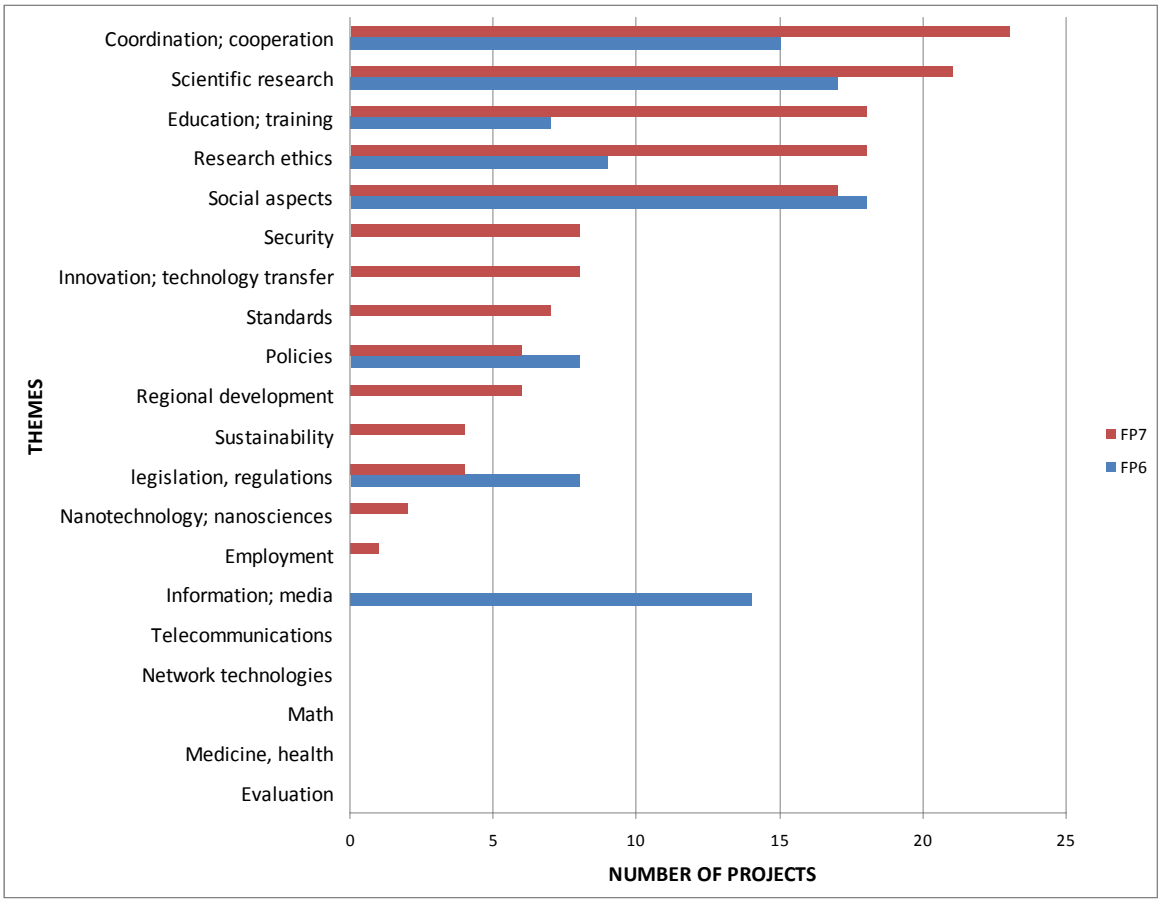

Figure 1. International Collaboration Beyond EU in FP6/FP7 SaS/SiS Projects – Main Themes and Number of Projects – Source: FP6/SaS and FP7/SiS websites/documents

3. Topics at Global Science Communication Conferences

One of the possibilities to detect international trends in science in society reflection and practice is to look at presentations and discussion topics at global conferences. Public Communication of Science and Technology (PCST) conferences have been since the early 1990s one of the main international occasions for discussing such topics. The conferences have gradually expanded their content to public engagement and science in society more broadly. They also offer a unique combination of scholars and practitioners' contributions and perspectives that many academic conferences miss.

A detailed analysis the topics of abstracts presented by non-EU contributors at PCST international conferences in 2010 (New Delhi, India), 2012 (Firenze, Italy) and 2014 (Salvador, Brazil) was conducted specifically for this report (Tab. 1). This analysis, as with other aspects of the present report, supports the view of science in society as a global concern, indicates some broadly shared trends, but also points to significant national and regional variations. The analysis shows, for example, that science communicators and scholars from India tend to focus on communication and engagement with science in rural areas and nutrition/health issues, whereas in China, priority attention has been given to science museum activities and impact evaluation issues, a relevant focus also for Australian contributions.

Climate change emerged as a key science communication topic in 2010, particularly in Australia, China, India and Korea. Latin America and Brazil in particular feature a specific interest for activities aimed at students and children as well as for the theme of scientific citizenship and social inclusion through science engagement, while North America and USA in particular saw a relevant proportion of contributions on the role of scientists and their training in science communication.

Engagement and citizenship are a relevant focus also for South Africa, which is also one of the areas explicitly thematising 'developing countries' as a context of science communication. Risk-related communication emerged as a key focus of contributions from Japan, mainly related to the Fukushima disaster.

In general terms, global trends show an increasing focus on government policies (see next section) and on the role of scientists in communicating research to the public, including training of researchers for communication, which is also referred to later. Compared to Europe, less attention seems to be given issues such as democratization, citizenship and communication in relation to scientific debates and controversies.

Overall, the key difference lies in the fact that contributions from Europe reflect an agenda of science in society and science communication that is internally consistent, professionally autonomous (to the point of being, to some extent, self referential) and relative independent from government setting[54]. On the other hand, non-European contributions tend to be more influenced – and in some cases directly influenced - by policy agendas through funding/shaping of organisational resources.

Source: authors' original elaboration from conference databases

4. Government Programmes on Science Awareness

As an increasingly prominent part of science or S&T policies, governments across the world set down targets and actions for increasing public awareness of science. For example, Japan's Science and Technology Basic Plan (2011-15) links innovation and knowledge creation with efforts to establish "a sound infrastructure of science and technology information and raise awareness and understanding of science and technology-related issues"[55]. The Japan Science and Technology Agency's divisions include a Centre for Science Communication, which, "in addition to communication conveying the knowledge and enjoyment of previous achievements in science and technology, also seeks to promote constructive communication by sharing the tentative nature, uncertainty,

54 The salience of climate change issues in several contributions from Europe is only apparently an exception. In many European countries, the relevance of the issue seems to have been substantially shaped by intergovernmental agendas and throughout media agenda and discourse, rather than by governmental policies. See for example Beltrame, Bucchi and Mattè (2013).

55 See http://www.jst.go.jp/EN/about/index.html#NOTE2

and latent risks possessed by science and technology with the nation's citizens, its government, its research institutions, and researchers, for a better society and lifestyle"[56].

This represents a more comprehensive view of public communication of science and of its contexts than may be found in many other similar documents. Perhaps the most frequently shared feature of such policies is a concern about children's and young people's competence in scientific and technical subjects and their attitudes to developments in science and technology. The context of this concern is also competitive: government policies are often targeted at closing a gap or maintaining a lead in relation to comparator countries.

Comparing four national science awareness programmes, Bultitude et al (2012) found that Brazil's and China's were more oriented to development and addressing social inequalities than those of Australia and Britain; emphasis on education was stronger for China and Britain, and emphasis on culture was strongest for Brazil. In the world's two most populous countries, China and India, the state's commitment to popularise science has been written into fundamental legislation for several decades. China's "science popularisation" programme employs many thousands of science communicators.

In a largely linear conception of the relations between education and economy, many government focus their attention on encouraging young people towards 'STEM' (science, technology, engineering and mathematics) subjects; this is widely seen as assisting skills supply to the economy. Informal education initiatives of the kind typically endorsed in programmes for science awareness are assigned a complementary role in this national effort. In countries where science communication has been institutionalised in recent years, the emphasis tends to be more strongly – or, in some cases, exclusively – on children and young people. This is reflected in programmes to build or support science centres.

The most ambitious programme by far is that of China, where the number of science and technology centres almost doubled, from 185 to 380, between 2004 and 2008 (Shi and Zhang 2012). In India and South Korea, science centres are counted in their tens or twenties and the networks have continued to expand through the 2000s and 2010s with support from regional authorities or state governments. Turkey (see Section 8 below) is planning to build over 70 science centres in all cities and large towns.

Various models can be found, illustrating that the development of science communication globally is uneven: the ArtScience Museum in Singapore is part of a commercial leisure and entertainment complex; Miraikan, the National Museum of Emerging Science and Innovation, in Japan states, as a founding principle, that "science and technology are part of our culture. We provide an open forum for all to ponder and discuss the future roles of science and technology"[57]; Petrosains in Malaysia (see Section 8b below) "is a Science Discovery Centre that uses a fun and interactive approach to tell the story of the science and technology of the petroleum industry", housed in one of the world's tallest buildings, built for the energy company, Petronas[58].

An Australian study of over a decade ago noted that it had not been established whether that country's awareness programme of the 1990s "caused Australians to become more or less aware of science and technology or of the part science plays in stimulating social and economic development" (Gascoigne and Metcalfe 2001); the authors recommended that evaluation needed to be built into such programmes from the start. That recommendation remains valid today.

5. International and Non-governmental Organisations

As well as national governments, international organisations of various kinds play significant roles in the diffusion of ideas and initiatives in science in society. The Organisation for Economic Co-Operation and Development is considering whether and how it could assess countries' comparative performance in this sector. UNESCO supports science communication initiatives and in October 2013 organised the First Regional Science Promotion

56 See http://www.jst.go.jp/EN/operations/operation2_c.html
57 See https://www.miraikan.jst.go.jp/en/aboutus/
58 See www.petrosains.com.my

conference in Serbia, bringing together science promotion professionals, practitioners and enthusiasts from south-eastern Europe to "share experience, network and formulate the next steps towards strengthening the link between science and society".

In Africa, global and continental inter-governmental organisations supported a 2012 workshop in Addis Abeba that gathered science and technology journalists from various African countries, heads of key media institutions and scientists to "discuss how best to communicate scientific issues to the public".

The non-governmental cultural relations agency, British Council, is a primary player in science communication, principally through the Famelab competitions. These are based on researchers presenting a chosen scientific topic in three minutes before non-specialist audiences and have spread to over 20 countries, mainly among the newer member-states of the European Union but also including Egypt, Hong Kong and Israel, The British Council has helped with the organisation and promotion of the competitions and with the provision of the associated training. The British Council has also helped organised science cafés in many countries and this format has also been applied elsewhere to familiarise scientists and others with communicating about science in informal public settings.

Also based in Britain, the Wellcome Trust has a very significant international programme in public engagement, now increasingly referred to as informal learning. Wellcome Trust support helped establish Café Khoa Huc in Vietnam, where Wellcome-supported medical researchers were aiming to create "a friendly atmosphere in which everyone feels free to question and offer their ideas". The spread of science cafés across the continents is a strong example of a global format, now adapted to local circumstances very widely. The international movement, Café Scientifique, counts 236 science cafés across all continents[59].

The promoters of these and similar initiatives, both professionals and volunteers, are often banded together in national associations of science communicators but REDPOP (Network for the Popularization of Science and Technology in Latin America and The Caribbean) is one of the few examples of a network of science communication professionals and agencies at continental level. REDPOP holds annual conferences around its region and stimulates reflections and research on issues in science in society.

Originating in Britain in 2002 with support from professional societies and private companies, the Science Media Centre (SMC) has come to be seen as a model capable of being applied in other countries; as of mid-2014, similar centres were established in Australia, Canada, Japan and New Zealand, with more planned[60].

Among non-governmental organisations, Scidev.net and the World Federation of Science Journalists (WFSJ) deserve specific mention. Scidev.net provides an Internet platform for reporting and discussion of scientific developments particularly in – or from the perspective of – less-developed countries. The service has the support of the journals, Nature and Science, and of development aid agencies and charities with a particular interest in supporting science and technology in developing countries. The WFSJ provides experienced mentors for journalists in developing countries wishing to specialise in science, and offers an online course in science reporting.

6. University Programmes in Science Communication

Over the past 25 years, programmes leading to awards specifically in science communication have come to be recognised as one of the features of a developed science communication infrastructure. From the earliest examples of Masters and Postgraduate Diplomas in science communication established in Australia, Britain, France, Italy and Spain, such programmes are now found in many western European and in Latin America, Asia

59 See http://www.cafescientifique.org/
60 See http://www.sciencemediacentre.net/

and Australasia.

In New Zealand, Otago University in 2014 recruited a second professor of science communication for its programmes; over half of its students in this field come from abroad. In Brazil, a Masters in Scientific and Cultural Communication was added to the existing offering in science journalism at the University of Campinas (Vogt et al. 2009). At the National Autonomous University of Mexico, the programme in science popularisation, started in 1996 through a close association with a science museum, has been linked to longer-established studies in the philosophy of science (Haynes 2009). Laurentian University, Ontario, Canada, set up a Graduate Diploma in Science Communication as a joint initiative with the Science North science centre, declaring it "North America's first and only comprehensive Science Communication program", though preparatory work on a new single-subject masters in science communication has begun at another Canadian university.

These programmes show some common characteristics across quite different cultural and educational settings, though the relative emphasis on social studies of science, communication theory and professional skills does vary considerably (Mulder et al 2008; Trench 2012). The trend is not in one direction only: there are also examples of programmes that have been reduced, suspended or cut as part of their host institutions' rationalisation (Trench 2012).

The countries that were earliest to establish postgraduate taught programmes have tended also to be the most strongly represented in formal academic research. In China, however, research in science communication has developed in the absence of postgraduate teaching in this subject area. The China Research Institute of Science Popularisation (CRISP) has facilitated many doctoral research projects, often also including periods of study abroad. A report on the development of science popularisation studies in China found 1,795 papers published between 2002 and 2007 (Ren, Yin and Li 2012).

An attempted characterisation of topics, theories and methods in current PhD research in science communication showed wide variation (van der Sanden and Trench 2010). While the pattern may be complex and even contradictory, the trend in numerical terms appears clear from informal evidence gathered for network meetings in 2012 and 2014 of early-career researchers: there may be more PhD projects in science communication currently underway than have been completed. A study of science communication research in Australia noted the increase in PhD students from three in 1997 to twenty in 2012, and a doubling of the output of research papers written by Australian researchers from the 1990s to the 2000s (Metcalfe and Gascoigne 2012).

A further outgrowth of postgraduate teaching in science communication has been the publication of specialist academic journals in the field. Joining *Public Understanding of Science* (Britain), *Science Communication* (USA) and *JCOM – Journal of Science Communication* (Italy), The *Japanese Journal of Science Communication* (Kyoto), *Indian Journal of Science Communication, Science Communicator* and *Journal of Scientific Temper*, all originating in India, have emerged in more recent years.

7. Supports for Scientists in Public Communication

Short courses in media and presentation skills are increasingly available to scientists and other academics from research funders, universities, professional societies and private providers. Courses are also provided on an international basis, as in the case of a 2011 communication course held at The World Academy of Sciences (TWAS) in Trieste, Italy, for scientists in developing countries; this was promoted on the basis that "communication skills are particularly important for scientists in developing countries, where the infrastructure for science is weak and where science education needs more support at all educational levels"[61]. The course hosts noted that "by improving their communication skills, scientists can play an important role in the development of science in their countries".

A cross-country survey reported a significant correlation between communication training and confidence

61 See http://twas.ictp.it/common/files/files-announce/ict-twas-workshop-on-science-communication

among researchers in communicating with the public (Peters et al. 2008). But in many countries where there are similar expectations of researchers that they engage in various ways with the general public, there is little or no provision of relevant training.

Despite the increasing attention to the broader "third mission" of higher education institutions, encompassing many aspects of civic engagement, and to public access to research centres, there are few formal incentives for scientists to be publicly active. The institutions and countries in which there is formal recognition of public communication in the selection and promotion of academics and researchers are exceptional, both within and beyond the EU. A study in the United Kingdom based on interviews with scientists reported that public engagement "is universally seen to be under-incentivised and under-rewarded, potentially detrimental to research, and professionally stigmatising" (Burchell, Franklin and Holden, 2009). In a letter to Nature, correspondents from leading research institutions and the national science centre in Japan noted that the government "has urged the researchers it funds to improve communication with the tax-paying public" but "time and effort spent on science communication will not help scientists to secure funding, promotion or employment" (Koizumi, Morita and Kawamoto 2013).

Communication training is often focused on early-career researchers or PhD students, as, for example, in the science and communication workshops held in recent years in India, with funding support from The Wellcome Trust and India's Department of Biotechnology. Meanwhile, training for wider groups involved in science communication is spreading, and increasingly internationalised: in September 2013 the first Euro-Mediterranean and Middle East Summer School of Science Communication took place in southern Spain, supporting science communication professionals in their efforts "to drive development of new science communication endeavours".

A key issue for the design and delivery of such training is the strength of emphasis on technical and formal aspects of communication. An approach to public communication oriented to dialogue requires preparing scientists to consider carefully the needs of their audiences and to listen well to their concerns. Encouraging scientists to take part in informal conversation, as at science cafés, may require specific forms of support (Trench and Miller 2012).

8. Country Reports

As a further means of demonstrating the global spread, the shared trends but also the national variations in science in society policies and programmes, we present in this section a series of brief reports outlining recent developments in selected countries. These countries span the continents but are deliberately chosen as cases that are not obvious regional leaders; in this way, they illustrate the percolation of ideas and concerns about science in society across the world. The reports all refer to the leading roles of government, of higher education and research sectors and of media and media professionals in promoting and implementing increased attention to science in society. They demonstrate the general trend for increased attention to science in society at the same time as they point to significant differentiation. More detailed reports might show better the weaker or stronger role of committed individuals, as mentioned explicitly below in the case of Mexico and implicitly in the reference to science broadcasting in New Zealand. Equally, the role of high-technology companies exemplified only in the Malaysia report might be a differentiation factor between countries.

Argentina[62]**:** The creation in 2007 of a ministry for science, technology and productive innovation was a signal of new times. Over recent years, R&D investment grew faster than in Europe, USA and Canada, though behind Asia. The public policy discourse shifted towards a knowledge economy and reducing dependence on commodities production. Within this framework, the importance of social communication of science, including the reinforcement of traditional museums and new science centres, has been emphasised.

Scientific institutions have progressively incorporated media and public-opinion orientations, as in the creation

62 Based on the contribution of Carmelo Polino to Trench et al, 2014

or consolidation of facilities for public communication in universities and S&T institutions; the intensification of contacts between scientists and journalists; the increasing salience of a rhetoric of engagement, dialogue and public inclusion. This is connected with tendencies for intellectuals and scientists in general to claim a stronger public role (Polino 2013).

However, institutional communication shows some structural weaknesses: despite university and federal institutions acknowledging the importance of press offices, funding is scarce: most of these groups have no guaranteed budgets or permanent positions to produce science communication materials, so many of their practices are voluntary (Polino 2013). Scientists are not clearly incentivised to engage in public communication.

Another problem is the conception of communication and the perception of the public that underlie many institutional initiatives in science communication and science popularisation. Many university efforts in science communication are still inspired by the notion that the public and journalists need to be educated (by the scientists). This produces an obvious tension, which is recreated many times in public lectures, talks and media interventions.

Science journalism is also becoming incrementally professionalised and institutionalised (Gallardo 2011; Vara 2007). During the past fifteen years, the media have appointed specialist journalists and increased coverage of S&T-related issues. Coverage of Argentina's research and development has become more prominent in the mass media. Science journalists have organized themselves through a network and a professional association[63]and young professionals with new expectations are entering science journalism and science popularisation (Bauer et al 2013). Many of these are coming through new university programmes (Murriello 2011), though the spread of science communication training programmes is still limited. We can also observe that media tend to favour descriptive rather than analytical perspectives; science news is often reduced to scientific discoveries, leaving out perspectives on risks, conflicts of interests or the connections between science and economy.

Malaysia[64]: The importance attached to science and technology has been reflected in several Malaysian government key policies such as Vision 2020, the 10th Malaysia Plan, the National Science and Technology Policy, the National Biotechnology Policy and the National Agricultural Policy. Related efforts to embed science and innovation in Malaysian society include the declaration of 2010 as Malaysia Innovation Year, 2011 as the Year for the Promotion of Science and Mathematics and 2012 as the National Science and Innovation Movement Year.

The National Science Centre (PSN) and Petrosains Science Discovery Centre are at the heart of science promotion in Malaysia. The first is run by the government under the auspices of the Ministry of Science, Technology and Innovation (MOSTI), and the second is the corporate contribution of Petronas, the leading oil and gas company. PSN defines itself as an informal learning institution that "hopes to raise interest, appreciation and understanding of the public of Science and Technology in order to increase scientific Malaysians". Petrosains stresses the wonder and excitement of science and discovery in appealing to audiences mainly of school-children and families. It also hosts a science festival for wider audiences, and with the ambition to add Kuala Lumpur to the cities around the world, "such as Edinburgh, New York, San Diego, Abu Dhabi and Singapore", that host successful science festivals.

PSN supports a programme for school students in rural areas to experience the learning of science and technology through interactive hands-on activities. The centre also conducts a special programme for teachers and organises competitions and carnivals to instil interest in science and technology. The National Planetarium is also active in educational and outreach programmes on space education (Zainuddin, 2008).

The Academy of Science Malaysia has initiated programmes such as competitions, science camps, Science and Mathematics Expo, National S&T Month and exhibitions and publications to enhance public awareness. Universities and schools throughout the country conduct science camps during the school holidays.

63 See http://www.radpc.org/

64 Based on the contribution of Latifah Amin to Trench et al, 2014

MOSTI has supported the MyBiotech@School programme which has exposed nearly 40,000 students throughout the country to biotechnology through hands-on experiments, multimedia shows, demonstrations and talks by scientists and industry experts (Mivil 2013; BIO-BORNEO 2013; Firdaus-Raih et al 2005). The Ministry of Natural Resources and Environment and the Department of the Environment have conducted environmental awareness programmes (Pudin et al 2005) while the Ministry of Health has organized health-related campaigns (MOH 2010; Malaysian Digest 2013; CAP 2011).

Mexico[65]**:** Over fifty years of active individual and institutional involvement in many forms of science communication, the sector has moved from one defined by volunteering to become a significant professional activity. Science communicators of many types are gathered in the Mexican Society for the Popularisation of Science and Technology, founded in 1986 and with over half of its members working in higher education and research institutions. These institutions are themselves at the forefront of science communication in the country.

The earliest initiatives were taken by Luis Estrada, a physicist of the National Autonomous University of Mexico (UNAM), later awarded the Unesco Kalinga Prize for his efforts. Today, UNAM through its Directorate of Science Dissemination operates two science museums and employs nearly 100 full-time science communicators, as well as organising public events, publishing several popular science publications and providing training in science communication. Over 300 students have completed the Diploma in Science Dissemination at UNAM in the past two decades and a new postgraduate programme in science communication is under development.

Other institutions active in the field include the Mexican Academy of Sciences, with its informal Sunday science talks, and the Mexican Society of Physics which has hosted Encounters in Science Communication for three decades. At government level, CONACyT (National Council for Science and Technology) takes responsibility for public science communication; it has been publishing popular science magazines for nearly forty years and organising a national Science and Technology Week for twenty years. It oversees a National Strategy for the Dissemination and Popularisation of Science Technology and Innovation and administers funds targeted at bringing science and technology to marginalised communities.

The Mexican Association of Science and Technology Museums and Centres was started in 1996 and its thirty member-centres are spread across the country. The experiences of science centres and their visitors are the single largest area of formal research in science communication, exploring the complexities of informal science learning in museums. Another strong strand of work is on evaluation of science communication projects and of science communicators themselves.

New Zealand[66]**:** New Zealand has defined itself with increasing emphasis in recent years as a high-technology and science-based economy, and this is represented in the appointment of a Minister of Science and Innovation and a Chief Science Adviser to the prime minister, but also in the level of public attention to science-based issues. A Royal Commission on Genetic Modification in 2000-01 received record numbers of public submissions and stated strongly in its report that "appropriate participation by all stakeholders" was needed in the decision-making process on such issues. In 2014, a draft National Statement of Science Investment was opened for a three-month period to public feedback.

Audio-visual communication of science for diverse publics has had a central role in the development of the professional and institutional structures of science communication in New Zealand. A 1950s radio programme, Science Report, is credited as one of the earliest science communication initiatives in New Zealand. Through the 1990s and 2000s there have been several such radio programmes on Radio New Zealand, their presenters including scientists who took up popularisation and professional broadcasters.

As a country with very distinctive natural features and habitats, New Zealand has been a base for internationally

65 Based on Sanchez-Mora at al, 2014

66 Based mainly on the presentation of Jean Fleming to PCST Conference, Salvador, Brazil, May 2014

significant natural history film- and documentary-making. This has also been the primary basis of the development of professional and academic education in science communication. Natural History New Zealand, based in Dunedin, has become a supplier to global outlets such as National Geographic, Animal Plant and Discovery.

Also in Dunedin, at University of Otago, a Masters in Science Communication was started in 2008; it attracts significant numbers of international and New Zealand students. The university's Centre of Science Communication at the University of Otago is the primary host of the 2018 Public Communication of Science and Technology conference, with support from government and the wider scientific and science communication sectors. New Zealand will become by a big margin the smallest country (in population) to host this biennial conference. The Science Communicators Association of New Zealand (SCANZ) was founded in 2004 with support from its longer-established Australian counterpart and hosts workshops, conferences and other events in several of New Zealand's larger cities.

Nigeria[67]**:** The future of the Nigerian economy is considered to be predicated on the rapid diffusion of science and technology as the government has adopted this approach as the best way forward for accelerated growth. The successes of the technology-driven mobile telephony industry in generating employment and increasing wealth no doubt contributed to this policy direction and to the hope that this success can be replicated in other sectors.

A science and technology summit held in Nigeria in 2010 aimed to stimulate the interest of the public in science, technology and innovation, to encourage indigenous researchers, inventors and innovators and to promote the domestication of modern technologies. A new science, technology and innovation (STI) policy was subsequently launched in 2011, emphasising innovation and technology transfer and setting specific objectives for the promotion of STI communication and inculcation of science culture.

The Nigeria Academy of Science provides advisory services for the federal government on STI, of which one was an audit of research and development agencies; one recommendation was for more synergy among the agencies and the institution of an annual national science and technology forum. The Academy is also actively involved in popularising science. In 2012, it held a workshop on effective communication of science research aimed at bridging the gap between scientists and the public and bringing together young scientists and journalists. The Academy also works with several partners on the SEED programme[68] which gives students and teachers the opportunity to work together on a research project. The programme provides learning and teaching resources, aiming to ignite a passion for science and develop the student's technical potential by building critical thinking, creativity and innovation skills.

The Nigerian press regularly feature science and technology articles and The Guardian, regarded as the flagship of the Nigeria press, has maintained regular science columns for several decades and media analysis (Falade 2014) has shown that the percentage of science in the news compares with what obtains in the United Kingdom and the United States.

Turkey[69]**:** Turkey has acknowledged the value of science communication through investment of large amounts of money to enhance public engagement with science and technology, promote a scientific culture, and develop a dialogical science communication culture. The Scientific and Technological Research Council of Turkey (TUBITAK), in cooperation with local authorities, has been establishing science centres around the country, aiming to complete a science centre in all 16 metropolitan areas by 2016, and in all 81 cities by 2023. TUBITAK is also responsible for promoting, funding and carrying out cutting-edge scientific research, and making the findings available to the public. It publishes popular science books as well as popular science magazines for children and for the general public.

67 Based on the contribution of Bankole Falade to Trench et al, 2014

68 See www.planetseed.com

69 Based on the contribution of Gultekin Cakmakci to Trench et al, 2014

The Ministry of National Education has also been working with TUBITAK and the Turkish Radio and Television Corporation on developing effective ways of science communication. The involvement of the education ministry reflects recent changes in science education: creating engaged and scientifically literate citizens has become a focus of the new science curriculum[70]. The new media literacy curriculum[71] specifically endorses public participation in policy debates about science-related social issues; this is seen as essential to maintain a healthy democracy (Cakmakci and Yalaki 2012).

However, there are few researchers in science communication and there is very limited output of research on science communication. There is no science communication division in any Faculty of Communication or in other faculties. The Turkish press often covers science and technology-related issues, but few of the newspapers have a separate science section.

Another challenge that Turkey faces with is the unsustainably short cycle of policies in science outreach. Over little more than a decade, the minister of education changed five times and each person in that role had different priorities, agendas and different kinds of science communication models. This has caused tensions among the public, policy-makers, science communication researchers and practitioners.

9. Closing remarks

Science in society has become in the past few decades a global concern and a global enterprise with important common denominators as well as distinctive regional characteristics. This reflects the broadly shared public policy attention to the knowledge economy as well as the increasing salience of science and of science-related issues to social and economic development generally. This global spread expands opportunities for applying common formats and sharing experiences and tools; this happens already at a fairly high level, engaging EU and non-EU partners with each other, for example, although largely through professional networks rather than governmental or inter-governmental initiative. The global spread presented here also enlarges the field for comparative analysis of similar approaches adopted in different contexts. Through such analysis the contextual interaction of science in society patterns with broader cultural, social and political landscapes becomes more visible.

It should be noted that the phrases, "science in society" and "science communication", are far from universally recognised, nor are they used uniformly, where they do occur. Some key terms and phrases have distinctive or exclusive usage in particular countries or regions: "scientific temper" in India, "science popularisation" in China, "social appropriation of science" in Latin America. But in disparate countries, with notably different cultural contexts, similar kinds of commitment are being made to promoting science and, with it, to promoting awareness and appreciation of science. Across these examples, there are similar references to science's role in technological and economic development and to the need to encourage interest in science particularly among children and young people.

In countries and regions with longer traditions of institutionalised science communication it is widely assumed that the preferable (and, in fact, dominant) approach to science in society is based on dialogue rather than on the 'deficit model' – that is, an approach based on an assumed lack of knowledge, trust or appreciation of science among the lay public. Whether or not this is generally the case in practice, the assumption does not apply in regions where the science communication culture is, in the terms of the European mapping mentioned above, "developing" or "fragile". (The MASIS report indicates that the depth of the science communication tradition and of democratic participation in a country influence the character of the science communication culture.) On the other hand, we have seen plentiful evidence that didactically oriented programmes of science awareness can co-exist with interactive and conversational forms of communication in science centres, science festivals and science cafés.

70 See Turkish Ministry of National Education, *Science Curriculum*, at http://goo.gl/jSSG5w
71 See http://www.medyaokuryazarligi.org.tr

Policy and reflection in the field of science in society in Europe should be aware of these general trends and regional diversity and be prepared to confront and take them into account, particularly as some of the areas treated above become increasingly relevant contexts for global research and its communication, models and experiences. In this light, the European Union and governments within and beyond the EU should consider how best to track changes in science in society, allowing for both comparisons among countries and with areas outside the EU. A framework for this task could be built by combining the template for national reports in the MASIS project and a process of validation of those reports through broader expert consultation, as represented in Science Culture in Canada (Council of Canadian Academies, 2014). This recent expert panel report analyses Canada's standing in terms of traditional statistical indicators of public perception and understanding of science but also looks at broader perspectives on science culture, considering, for example, citizen science and relationships with indigenous knowledge. Also, thorough understanding of trends in European science culture in a global context might benefit from going beyond the aggregation of trends at the national level, for example by looking at the emergence of actors, interaction styles and audiences cross-cutting different countries.

Taking greater account of the global dimension should reinforce the view that the models of science/society interaction are not to be seen in evolutionary or hierarchical perspective, i.e. that 'dialogue' or 'public engagement' is a necessary and improved replacement of 'deficit' and 'dissemination'. On a global scale, but also in given (and changing) local contexts, any or all of these approaches – and others besides – may have their place. The global overview highlights how difficult and even misleading it would be to expect a single, straightforward response to contemporary challenges of science in society such as those outlined above, or to fulfil the expectation of eventually finding the 'best' and most appropriate, one-size-fits-all model and toolbox.

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Annex 1 – SiS-FP7 Projects with International Partners

Project Acronym	Project Title	Coordinator (name of the organization and country)	Number of partners involved	Start Date	End Date	Duration (Months)	Total Cost (€)	Total Funding (€)	Contract Type
2WAYS	Two ways for communicating european research about life sciences with science festivals & science centres/ museums, science parliaments impact survey	AUSTRIA-EUROPEAN SCIENCE EVENTS ASSOCIATION	6	01 -01-09	31-12-10	24	992076	966600	CSA-SA
ACCENT;	Action on climate change through engagement, networks and tools	ITALY-FONDAZIONE IDIS-CITTÀ DELLA SCIENZA	14	01-04-09	31-03-11	24	1348965	1017880	CSA-CA
ACUMEN;	Academic Careers Understood through Measurement and Norms	NETHERLANDS-UNIVERSITEIT LEIDEN	9	01-03-11	28-02-14	36	2025827	1495412	CP-FP
ASSET	Action plan on sis related issues in epidemics and total pandemics	FRANCE-VITAMIB SAS	14	01-01-14	31-12-17	36	4496454	EUR 3 939 880	CSA-SA
BEWATER	Making society an active participant in water adaptation to global change	SPAIN-CENTRO DE INVESTIGACION ECOLOGICA YAPLICACIONES FORESTALES	11	01-10-13	31-03-17	42	3588713	2934724	CSA-SA
CASC	Cities and science communication: innovative approaches to engaging the public	UK-BIRMINGHAM CITY COUNCIL	19	01-05-09	28-02-11	21	1119582	870980	CSA-CA
CEECEC	CSO engagement with ecological economics	SPAIN-NIVERSITAT AUTONOMA DE BARCELONA	13	01-04-08	30-09-10	30	814101	730011	
CHREACT	Chain Reaction: A Sustainable Approach to Inquiry Based Science Education	UK-SHEFFIELD HALLAM UNIVERSITY	11	01-06-13	31-05-16	36	4040400	3601587	CSA-SA
COREFLECT;	Digital support for inquiry, collaboration, and reflection on socio-scientific debates	CYPRUS-CYPRUS UNIVERSITY OF TECHNOLOGY	7	01-03-08	28-02-11	36	916260	768942	CSA-CA
ECB	European Coordinating Body in Maths, Science and Technology Education	BELGIUM-EUN PARTNERSHIP AISBL	28	01-02-11	31-10-14	36	8134001	3578912	CSA-SA
EJOLT	Environmental Justice Organizations, Liabilities and Trade	SPAIN-UNIVERSITAT AUTONOMA DE BARCELONA	19	15-03-11	14-03-15	48	4078038	3651921	CSA-SA

ENGAGE;	Equipping the Next Generation for Active Engagement in Science	UK-SHEFFIELD HALLAM UNIVERSITY	13	01-01-14	31-12-16	24	2804226	2476238	CSA-SA
ENGINEER;	brEaking New Ground IN the sciencE Education Realm	ISRAEL-BLOOMFIELD SCIENCE MUSEUM JERUSALEM (BSMJ)	25	01-10-11	30-09-14	36	3151188	2795871	CSA-SA
EPOCH	Ethics in Public Policy Making: The Case of Human Enhancement	UK-UNIVERSITY OF BRISTOL	9	01-11-10	31-10-12	24	1477603	1150012	CP-FP
ETHICAL	Promoting international debate on ethical implications of data collection, use and retention for biometric and medical applications	GERMANY-FRAUNHOFER-GESELLSCHAFT ZUR FOERDERUNG DER ANGEWANDTEN FORSCHUNG E.V	7	01-01-09	31-12-10	24	1080930	742394	CSA-CA
EUROSIS	EUROSIS	GREECE-EUROSCIENCE GREEK REGIONAL SECTION	34	01-02-08	30-06-10	29	1292380	1201886	CSA-CA
EUZOOS-XXI	EU Zoos and science in the 21st Century: engaging the public in nature conservation	SWEDEN-NORDECONSULT SWEDEN AB	6	01-09-09	31-08-12	36	862134	758178	CSA-CA
FASMED	Improving progress for lower achievers through Formative Assessment in Science and Mathematics Education	UK-UNIVERSITY OF NEWCASTLE UPON TYNE	8	01-01-14	31-12-16	24	2478828	1918076	CP-FP
FIBONACCI;	The FIBONACCI Project - Large scale dissemination of inquiry based science and mathematics education	FRANCE-ECOLE NORMALE SUPERIEURE	26	01-01-10	28-02-13	38	5343520	4784597	CSA-SA
GENDERA	Gender Debate in the European Research Area	non indicato-TUDOMANYOS ES TECHNOLOGIAI ALAPITVANY	8	01-11-09	30-04-12	30	1030585	798666	CSA-SA
GENDER-NET	Promoting gender equality in research institutions and the integration of the gender dimension in research contents	FRANCE-CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE	11	15-10-13	14-10-16	36	1931665	1545219	CSA-CA
GENDERTIME;	Transfering Implementing Monitoring Equality	FRANCE-EGALITE DES CHANCES DANS LES ETUDESET LA PROFESSION D'INGENIEUR EN EUROPE ASSOCIACION	9	01-01-13	31-12-16	36	3329404	2328077	CSA-SA
GENIS LAB	The Gender in Science and Technology LAB	ITALY-FONDAZIONE GIACOMO BRODOLINI	8	01-01-11	31-12-14	36	2393332	1674932	CSA-SA
GEST	Global Ethics in Science and Technology	UK-UNIVERSITY OF CENTRAL LANCASHIRE	4	01-02-11	30-04-14	39	892295	696820	CP-FP
HELENA;	Higher education leading to engineering and scientific careers	LITHUANIA-SIAULIU UNIVERSITETAS	6	01-04-09	30-09-11	30	1212390	930433	CP

HIDE	Homeland security, biometric identification and personal detection ethics	ITALY-CENTRE FOR SCIENCE, SOCIETY AND CITIZENSHIP	10	01-02-08	31-01-11	36	1244393	963762	CSA-CA
HIPST	History and Philosophy in Science Teaching	GERMANY-DEUTSCHE GESELLSCHAFT FUR INTERNATIONALE ZUSAMMENARBEIT (GIZ) GMBH	10	01-02-08	31-07-10	30	1099238	998211	CSA-CA
INNOVA-P2	Pharma-innovation - patent-2	UK-UNIVERSITY OF CENTRAL LANCASHIRE	7	01-06-08	31-05-11	36	930130	728640	CP-FP
INQUIRE;	Inquiry-based teacher training for a sustainable future	AUSTRIA-UNIVERSITAET INNSBRUCK	18	01-12-10	30-11-13	36	4040400	3601587	CSA-SA
IRRESISTIBLE;	Including Responsible Research and innovation in cutting Edge Science and Inquiry-based Science education to improve Teacher's Ability of Bridging Learning Environments	NETHERLANDS-RIJKSUNIVERSITEIT GRONINGEN	13	01-11-13	31-10-16	36	2795284	2498840	CSA-SA
ISWA	Immersion in the Science Worlds through Arts	ITALY-UNIVERSITA POLITECNICA DELLE MARCHE	15	01-03-11	28-02-13	24	1225522	1103791	CSA-SA
KIDSINNSCIENCE	Innovation in Science Education - Turning Kids on to Science	AUSTRIA-Ã–STERREICHISCHES Ã–KOLOGIE-INSTITUT	9	01-11-09	31-07-13	45	1233444	999224	CP-FP-SICA
MIC	My ideal city	ITALY-MUSEO TRIDENTINO DI SCIENZE NATURALI	4	01-06-09	31-05-11	24	776000	682070	CSA-CA
NANOCODE	A multistakeholder dialogue providing inputs to implement the European Code of Conduct for Nanosciences & Nanotechnologies (N&N) research	ITALY-ASSOCIAZIONE ITALIANA PER LA RICERCA INDUSTRIALE - AIRI	9	01-01-10	30-11-11	23	1417801	1243777	CSA-SA
NECOBELAC	Network of collaboration between Europe and Latin American Caribbean countries to spread know-how in scientific writing and provide the best tools to exploit open access information in public health	ITALY-ISTITUTO SUPERIORE DI SANITA	5	01-02-09	31-07-12	42	907177	800000	CSA-CA
PARRISE;	Promoting Attainment of Responsible Research and Innovation in Science Education	NETHERLANDS-UNIVERSITEIT UTRECHT	17	01-01-14	31-12-17	36	2899979	2498125	CSA-SA
PATHWAY	The Pathway to Inquiry Based Science Teaching	GERMANY-UNIVERSITAET BAYREUTH	27	01-01-11	31-12-13	24	4143983	3378770	CSA-SA

PATS	Privacy awareness through security branding	GERMANY-TECHNISCHE UNIVERSITAT BERLIN	6	01-08-09	31-03-12	32	1080607	964594	CSA-SA
PERARES	Public Engagement with Research and Research Engagement with Society	Netherlands-RIJKSUNIVERSITEIT GRONINGEN	19	01-05-10	31-10-14	54	3085511	2728041	CSA-CA
PRACTIS;	Privacy - Appraising challenges to technologies and ethics	ISRAEL-INTERDISCIPLINARY CENTER FOR TECHNOLOGICAL ANALYSIS AND FORECASTING	7	01-01-10	31-03-13	38	1267956	988456	CP-FP
PRAGES	Practising gender equality in science	ITALY-DIPARTIMENTO PER I DIRITTI E LE PARI OPPORTUNITA	10	01-04-08	31-12-09		1498040	998418	CSA-CA
PROFILES	Professional Reflection-Oriented Focus on Inquiry-based Learning and Education though Science	GERMANY-FREIE UNIVERSITAET BERLIN	23	01-12-10	30-11-14	48	3837022	3447910	CSA-SA
PROGRESS	PROmoting Global REsponsible research and Social and Scientific innovation	UK-UNIVERSITY OF CENTRAL LANCASHIRE	9	01-02-13	31-01-16	36	1715490	1486664	CSA-SA
RESPONSIBILITY;	Global Model and Observatory for International Responsible Research and Innovation Coordination	GERMANY-FRAUNHOFER-GESELLSCHAFT ZUR FOERDERUNG DER ANGEWANDTEN FORSCHUNG E.V	12	01-02-13	31-01-16	36	1779733	1484427	CSA-CA
RISE	Rising pan-european and international awareness of biometrics and security ethics	ITALY-CENTRE FOR SCIENCE, SOCIETY AND CITIZENSHIP	9	01-03-09	29-02-12	36	1253746	919501	CSA-CA
RRI TOOLS;	RRI TOOLS, a project to foster Responsible Research and Innovation for society, with society	SPAIN-FUNDACIO CAIXA D'ESTALVIS I PENSIONS DE BARCELONA	25	01-01-14	31-12-16	24	7762043	6942 31	CSA-SA
SATORI;	Stakeholders Acting Together On the ethical impact assessment of Research and Innovation	NETHERLANDS-UNIVERSITEIT TWENTE	15	01-01-14	30-09-17	46	4723129	3662800	CSA-SA
SED	Science Education for Diversity	UK-THE UNIVERSITY OF EXETER	5	01-01-10	31-12-12	24	1409821	999982	CP-FP-SICA
SERSCIDA;	Support for Establishment of National/Regional Social Sciences Data Archives	BOSNIA HERZEGOVINA-UNIVERZITET U SARAJEVU	6	01-01-12	30-06-14	30	699025	625573	n.a.
SET-DEV	Science, etchics and technological responsibility in developing and emerging countries	ITALY-CONSIGLIO NAZIONALE DELLE RICERCHE	10	01-03-08	31-05-11	39	1590047	1343477	CSA-CA
SHEMERA	Euro-Mediterranean research cooperation on gender and science: SHE Euro-Mediterranean Research Area	BELGIUM-UNIVERSITE LIBRE DE BRUXELLES	17	01-05-11	31-10-14	42	2363343	1991838	CP-FP-SICA

SIS.NET	Network of Science in Society National Contact Points	ICELAND-THE ICELANDIC CENTRE FOR RESEARCH	11	01-11-11	30-06-14	32	683858	599989	CSA-SA
SIFORAGE;	Social Innovation on active and healthy ageing for sustainable economic growth	SPAIN-UNIVERSITAT DE BARCELONA	18	01-11-12	31-10-16	36	4093588	3484788	CSA-SA
SISOB	An Observatorium for Science in Society based in Social Models	SPAIN-UNIVERSIDAD DE MALAGA	7	01-01-11	31-12-13	24	1810212	1411858	CP-FP
S-TEAM	Science teacher education advanced methods	NORWAY-NTNU - NORGES TEKNISK-NATURVITENSKAPELIGE UNIVERSITET	26	01-05-09	30-04-12	36	5240157	4699928	CSA-SA
STUDIOLAB;	a new European platform for creative interactions between art and science	IRELAND-THE PROVOST, FELLOWS, FOUNDATION SCHOLARS & THE OTHER MEMBERS OF BOARD OF THE COLLEGE OF THE HOLY & UNDIVIDED TRINITY OF QUEEN ELIZABETH NEAR DUBLIN	13	01-07-11	31-12-14	42	1652634	1496349	CSA-SA
SYN-ENERGENE;	Engaging with New and Emerging Science and Technology in Responsible Governance of the Science and Society Relationship	GERMANY-Karlsruher Institut fuer Technologie	27	01-07-13	30-06-17	48	4590081	3960810	CSA-SA
SYNTH-ETHICS	Ethical and regulatory challenges raised by synthetic biology	NETHERLANDS-TECHNISCHE UNIVERSITEIT DELFT	4	01-03-09	31-08-11		770608	531276	CP
TEMI;	Teaching Enquiry with Mysteries Incorporated	UK-QUEEN MARY UNIVERSITY OF LONDON	13	01-02-13	31-07-16	42	3558128	3135919	CSA-SA
TRACES	Transformative Research Activities. Cultural diversities and Education in Science	ITALY-UNIVERSITA DEGLI STUDI DI NAPOLI FEDERICO II.	5	01-07-10	30-06-12	24	1198000	996700	CP-FP-SICA
TWIST;	Towards Women In Science and Technology	DENMARK-CENTER FOR FORMIDLING AF NATURVIDENSKAB OG MODERNE TEKNOLOGI FOND	10	01-01-10	31-12-12	24	3048097	2755692	CSA-SA

***SICA: Small/medium-scale focused research project for specific cooperation actions dedicated to international cooperation partner countries(SICA); CP-FP: Small or medium-scale focused research project; CSA-CA: Coordination (or networking) actions; CSA-SA: Support actions; CP: Collaborative project (generic).*

Notes on contributors

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