Stock-taking and meta-analysis of Science in Society projects throughout FP6 and FP7

Final Report

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This report was prepared by EY, Open Evidence and Wuppertal Institute for the European Commission, Directorate General Research & Innovation.

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List of Abbreviations

CP	Collaborative projects
CSA	Coordination and support actions
CSCP	Civil Society and Citizen Participation
CSO	Civil Society Organisation
DG RTD	Directorate-General for Research and Innovation
DGs	Directorates-General
DoW	Description of Work
EC	European Commission
EGE	European Group of Ethics
ELS	Ethical, Legal and Social
EPWS	European Platform of Women Scientists
ERA	European Research Area
ERC	European Research Council
EU	European Union
FP	Framework Programme
FP6	Sixth Framework Programme for Research
FP7	Seventh Framework Programme for Research
H2020	Horizon 2020
HES	Higher or secondary education
IBSE	Inquiry Based Science Education
ICT	Information and Communication Technologies
KPI	Key Performance Indicators
MASIS	Monitoring Activities of Science in Society
MML	Mobilisation and Mutual Learning
MMLAP	Mobilisation and Mutual Learning Action Plans
MoRRI	Monitoring Responsible Research and Innovation
MS	Member State
NCP	National Contact Point
NGO	Non-Governmental Organisation
NMP	Nanosciences, Nanotechnologies, Materials and new Production Technologies (Specific Programme "Cooperation")
OAOS	Open Access, Open Science
OECD	Organisation for Economic Co-operation and Development
OTH	Other
PRC	Private commercial
PUB	Public body
R&D	Research and Development
R&I	Research and Innovation
REC	Research Centres
RFO	Research Funding Organisation
RPO	Research Performing Organisation
RRI	Responsible Research and Innovation
RTO	Research and Technology Organisations
SaS	Science and Society, FP6 programme
S&T	Science and Technology
SiS	Science in Society, FP7 programme
SSA	Specific Support Actions
STEAM	Science, Technology, Engineering, Arts and Mathematics
STEM	Science, Technology, Engineering and Mathematics
STI	Science, Technology and Innovation
SwafS	Science with and for Society, H2020 programme
SxS	Science and/in Society
ToR	Terms of reference
WP	Work Programme

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INTRODUCTION

This report presents the results of the study "*Stock-taking and meta-analysis of Science in Society projects throughout FP6 and FP7".* The study was commissioned by the European Commission, Directorate-General for Research & Innovation. The study was led by EY with the support of Open Evidence and Wuppertal Institute.

Objectives and scope of the study

The study aimed at assessing and reporting on the implementation, results, and wider impacts of the "*Science and Society*" (hereinafter referred to as "SaS") and "*Science in Society*" (hereinafter referred to as "SiS") programmes, projects and activities in Framework Programme 6 and 7 (FP6 and FP7) - as well as their legacy in the development of '*Science with and for Society*' (hereinafter referred to as "SwafS") in Horizon 2020.

The study had two specific objectives:

- Taking stock of the implementation, results and impacts of the SaS and SiS projects in FP6 and FP7, in order to update the existing studies and evaluation reports, and to create a solid evidence base for the analysis (stock-taking);
- Transversal analysis of the collected data and information to answer questions relating to multiple levels (i.e. programme, project and policy level) as well as to evaluate relevant horizontal issues (meta-analysis).

Structure of the report

The report is structured as follows:

- Chapter 1**Error! Reference source not found.** - Background of the study: provides an overview of the policy context during the course of the study and societal discourse related to the Science and/in Society programmes (hereafter also "SxS programmes"); a discourse analysis of the six thematic dimensions of the programmes and a description of the links to other EU policies;
- Chapter 2 - Methodological Framework: provides a description of the levels of analysis and an overview of the methodologies used to collect and analyse data and information;
- Chapter 3 – SaS and SiS programmes main findings: presents the main findings of the composition analysis and a description of the main characteristics of the funded projects;
- Chapter 4 – Evaluation results: illustrates the results obtained from the evaluation at project, programme and other policy level;
- Chapter **Error! Bookmark not defined.** – Conclusions and recommendations: presents the main conclusions resulting from the evaluation and policy recommendations in view of supporting the reflection on future developments of the SwafS programme.

1 BACKGROUND OF THE STUDY

1.1 The need to strengthen the link between science and society

The SaS and the SiS specific programmes, in combination with a number of projects outside those programmes but related to SaS and SiS content and objectives (hereinafter referred to as "SxS related projects"), have laid foundations for strengthening links between science and society.

The approach of the SaS and SiS programmes has been further developed by Horizon 2020 into two approaches. On the one hand, RRI was established as a cross-cutting issue supporting the integration of criteria such as public engagement, gender equality, ethics, science education and open access. On the other hand, Article 14.1(l) and Annex 1, Part V, under the heading SwafS defines RRI as a specific activity. Under this specific programme, projects and actions promote RRI systemically at institutional level, to achieve a deeper and lasting impact.

In modern industrialised societies, the generation of new goods and services goes hand in hand with the generation of risks. Technological and social innovations not only result in improvements of living conditions (or growth and jobs as it is framed in the Europe 2020 strategy) but also results in a variety of social, economic, and ecological impacts. Many of these impacts are unintended and can put the potential societal benefits of innovation, or even the development of society as a whole, at risk. The global economic development and technological progress is not necessarily aligned with the values, needs and expectations of European society. This requires a more reflexive mode of research and innovation policies or, in other words, responsible research and innovation.

Research and innovation fundamentally impacts on almost every aspect of life. Economic sectors such as food, housing, mobility, military, communication, energy and transport determine our quality of life and are constantly evolving as a result of research and innovation. However, it is no longer self-evident that research and innovation meets the needs of society. Indeed, highly controversial innovations have been rejected in part of in whole by society or the governments that represent them, such as genetic modifications or prenatal diagnostics and nuclear energy. Innovation often has a price, e.g. the surging social media and networks go hand in hand with more scrutiny by network providers and others. Even though consumers gain additional services, they have to pay with less privacy and more intrusion into their private lives (for instance via advertising). Biofuels, which were originally supposed to reduce environmental pressure from carbon emissions, have eventually contributed to greater pressure on biodiversity and can negatively influence the living conditions of farmers, as well as food security, primarily in developing countries. Moreover, the commercial large-scale application of pesticides and genetically modified organisms can lead to undesirable social, economic and ecological risks.

These are just a few examples highlighting how important it is that research and innovation meets the needs of society while simultaneously avoids creating more risks than benefits. How can Europe reach a consensus about the direction and boundaries to research and innovation? How can this bring improvements in quality of life not only for Europeans but also for citizens beyond the European borders and future generations?

A way to answer these increasingly pressing questions for science is to enter into an exchange between scientists and the rest of society. "Early and continuous iterative engagement of society in research and innovation is essential to make innovation adequate and acceptable".[1]

[1] http://www.euroscientist.com/ec-implementing-rri-institutional-change/

1.2 Overview of SaS and SiS programmes

1.2.1 Objectives and structure of SaS and SiS programmes

Strengthening the relationship between science and society was and is the overarching objective of Science and/in Society.

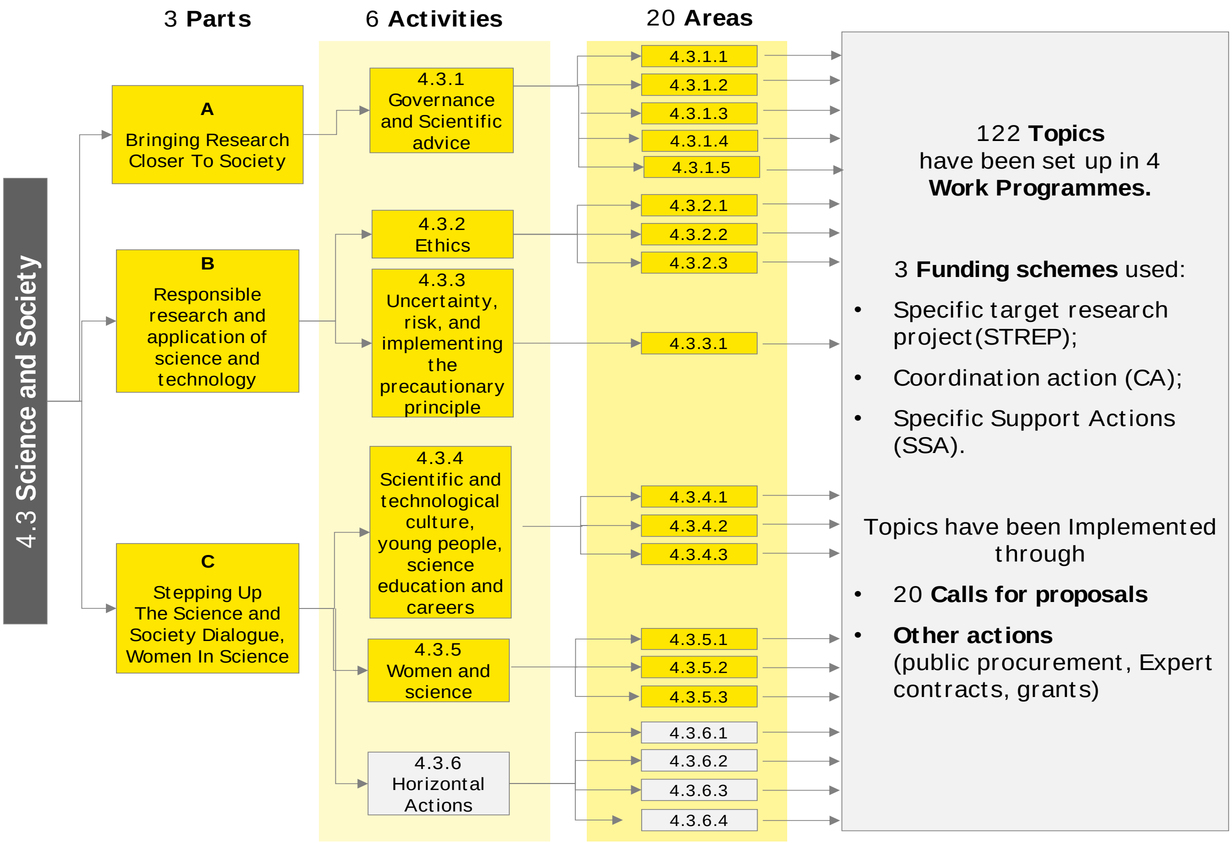
This objective was laid out in the "Science and Society Action Plan" (Commission of the European Communities, 2001; EC, 2002), which established the need for a new partnership between science and society to meet the strategic goal of the Lisbon Agenda: becoming the most dynamic knowledge-based economy in the world, capable of sustainable economic growth with more and better jobs and greater social cohesion.

The Science and Society Action Plan was designed to achieve three strategic objectives: (1) Promote scientific and education culture in Europe, (2) bring science policies closer to European citizens, and (3) put responsible science and innovation at the heart of policy making.

The Science and Society programme was launched under Structuring the European Research Area in FP6. The programme ran from 2002 to 2006 with a budget of €80 million. While the SaS programme was used to implement the Science and Society Action Plan, it did not mimic one-to-one the structure of the Action Plan.

The overarching aim of the Science and Society programme was to create structural links between the many institutions and provide a bridge between activities concerned with both science and society.

Figure 1 - Overview of the Science and Society programme



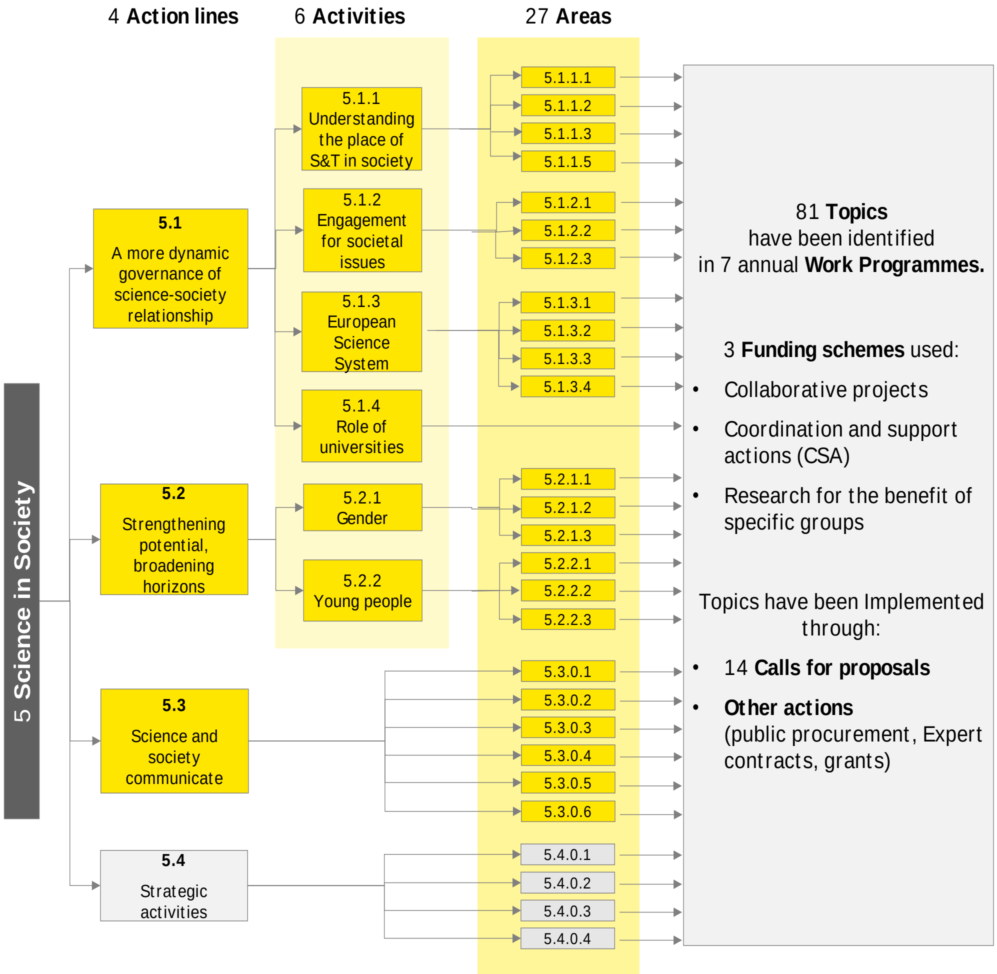
Source: Authors' elaboration based on public documents

The FP6 SaS programme was based on a two-pillar strategy:

1. SaS as a separate component of FP6 – having the stated overarching objective of developing structural links between institutions and activities concerned with the dialogue between science and society. It focused on three main axes:
   A) "Bringing Research Closer to Society",
   B) "Responsible Research and the Application of Science and Technology", and
   C) "Stepping up the Science/Society Dialogue and women and science".
2. SaS as an integral part of FP6 – incorporated into the FP6 rules of participation and reporting guidelines, FP6-funded research projects (such as integrated projects, networks of excellence and accompanying actions) were required to take into account relevant science and society issues (gender in scientific research, ethical issues, public awareness, debate and education). SaS as an integral part of FP6 aimed to provide common reference frameworks and approaches to guide actions in different FP6 areas.

The successor of the FP6 Science and Society programme was the "Science in Society" in FP7. The SiS programme ran from 2007 to 2013 with a budget of €330 million. The overarching objective of Science in Society was to "stimulate the harmonious integration of scientific and technological endeavour and associated research policies in the European social web, by encouraging reflections and debate on science and technology, and their relation with the whole spectrum of society and culture" (Council of the European Union, 2006).

Figure 2 - Overview of the Science in Society programme



Source: Authors' elaboration based on public documents

The FP7-SiS programme, as outlined in the FP7 Capacities Work Programme: Science in Society 2007, was structured through four lines:

1. A more dynamic governance of the science and society relationship;
2. Strengthening potential, broadening horizons;
3. Science and society communicate;
4. Strategic Activities.

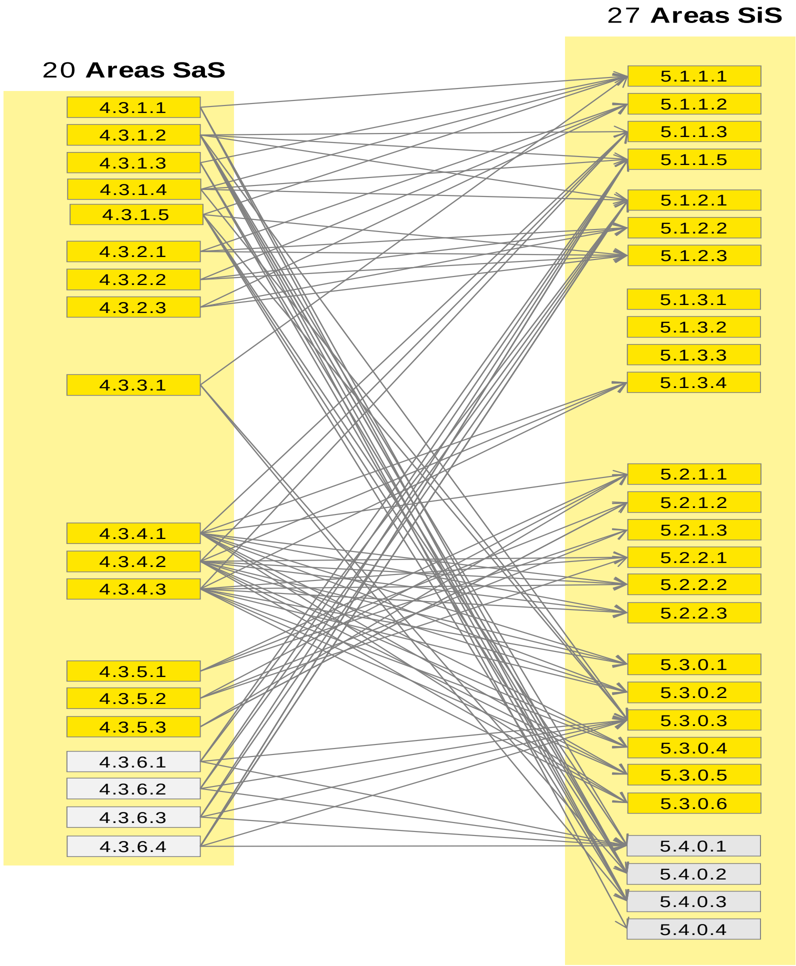
1.2.2 Evolution from SaS to SiS

The contents and structures (including activities and thematic areas) of the Work Programmes (WP) evolved from FP6 to FP7 to meet the demand for the inclusion of ethical, legal and social (ELS) issues into science and research activities in the European Research Area (ERA). Such evolutions did not necessarily take clear-cut and consistent development pathways. The study analysed the continuity of activities and thematic areas firstly in the SaS WPs and in the SiS WPs; while some activities and areas disappeared, others multiplied and branched-out. These changes resulted in shifting priorities, merging areas or growing thematic clusters.

The analysis of the continuity from one programme to the other, as sketched in Figure 3**Error! Reference source not found.** below, is complex and reveals four major patterns:

1. Complete discontinuity of some areas;
2. Continuity of areas, from one programme (SaS) to the other (SiS), in both structure and content;
3. Continuity of areas only in content but not in structure;
4. Emergence of new areas in SiS.

Figure 3 - Thematic areas of the evaluation



Source: Authors' elaboration based on public documents

However, the structural breaks and discontinuities of activities and thematic areas between the two programmes (e.g. Area: 4.3.4 - Scientific and technological culture, young people, science, education and careers) suggested that the structural analysis alone was not sufficient to provide the insights necessary to understand the evolution of both programmes. Thus, next to the structural analysis, the research team performed a cross-cutting analysis aimed at establishing the meaning and context of the activities and thematic areas in the SaS and SiS WPs, in particular regarding their evolution from the beginning of FP6 towards FP7 and into Horizon 2020.

This cross-cutting analysis was aligned with six main thematic dimensions:

- **Gender and science**: including the aspects of gender awareness, empowerment and training, gender budgeting;
- **Science literacy**: including aspects of formal/informal education, science communication and science literacy;
- **Science and ethics**: including ethical governance, bio- and nano-ethics, and techno-ethics;
- **Governance and scientific advice**: including science governance, risk governance and RRI;
- **Civil society and citizen participation**: including civil society organisation (CSO) participation, public engagement and citizen involvement;
- **Open access, open science**: including open access, open science and open innovation.

These thematic dimensions are more than just activity areas addressed by European work programmes, they represent horizontal policy areas of European science, research and innovation policy in general. They are further described in the following section.

1.3 SaS - SiS dimensions

Policy making in the science-society domain takes place in horizontal and evolving policy discourse arenas. In order to better understand the broader context in which FP6-SaS and FP7-SiS were implemented, the following sections describe the evolution of the six horizontal science-society policy areas. Given the complex and non-linear nature of this domain, these paragraphs are only intended to provide snapshots of on-going discourses, sketching the outlines of main ideas, concepts and evolutions.

1.3.1 Gender and science

In the recent EU policy discourse regarding gender equality in science, research and technological development, the gender equality strategy is defined in a three-dimensional structure, aiming at:

- Supporting the integration of women in all fields and at all levels in research and innovation activities (reducing horizontal and vertical segregation);
- Fostering structural changes in science and research institutions in order to suppress structural barriers for women (e.g. through the implementation of comprehensive gender equality plans, quotas for women, transparent decision-making);
- Promoting the integration of the gender dimension in the content of research and innovation actions to ensure that both men and women's needs and interests are addressed adequately.

So far, these three aspects have been addressed unevenly. Significant effort has been deployed to address the integration of women in research and innovation and valuable concepts have been developed into concrete actions for achieving structural change in institutions.[2] However, the integration of the gender dimension in the content of science, research and innovation actions has only begun with a few selected initiatives.[3]

To overcome the gender bias in science, research and technological development, three policy approaches can be identified (Caprile et al. 2012; Schiebinger, L. and Schraudner, M. 2011):

- "Fixing the number" of women employed in science, research and innovation activities;

[2] In 1999, the Commission adopted an action plan on women in science (COM (1999) 76) aiming at promoting gender equality in scientific research through both specific policy-oriented actions (in the context of the so-called Policy Forum) and gender mainstreaming measures within the Research Framework Programmes (the Gender Watch System). In February 2011, the European Commission convened an Expert Group on Structural Change to assist the Commission in identifying the most appropriate means to reinforce structural change activities in cooperation with EU MS and Associated countries. The Group identified the solutions to foster the structural change in universities and research institutions and issued recommendations in the form of a gender equality strategy with key steps for actors at the EU, national and institutional level (European Commission, 2012). Since 2010, tailored gender action plans have been implemented within European research organisations and universities as a result of some SiS projects (e.g. INTEGER, GENIS LAB, STAGES, GENDERTIME, GENOVATE, EGERA, TRIGGER).

[3] As confirmed by the GENDER-NET, the first European Research Area Network (ERA-NET) project : 'Comparative analysis of existing national initiatives on the integration of the gender dimension in research contents', gender balance/equality in research contents is less developed than gender balance/gender equality in research careers in terms of policy and strategy development (GENDER-NET Final Report, 2016).

- "Fixing the institutions": reform of science and research organisations as well as science and research funding organisations to improve gender equality responsible organisation structures and practices; and
- "Fixing the knowledge": fixing the integration of the gender dimension in research and innovation content and academic curricula, by targeted active analysis of inherent gender bias and by incorporating gender analysis into all phases of basic and applied research, from priority setting to funding decisions, establishing objectives and methodologies, data gathering, and so on.

In 2007, the European Commission broadened its approach to the gender dimension from "fixing women employed in science and research" to "fixing the institutions" in line with a United Nations and EU-established process-related approach of gender mainstreaming (Lipinsky, 2014). More recently, the European Platform of Women Scientists (EPWS), initiated through an FP6 SaS project, pointed out that there are still major shortcomings regarding the integration of the gender dimension in research and innovation content and academic curricula (the third approach). Even though there have been consistent efforts to address gender equality, the EPWS explained the disappointingly small increase in the number of women in science and the lack of continuity in integration, highlighting that by focusing primarily on "fixing the number and institutions", gender equality cannot sufficiently be achieved, because gender qualitative definitions of science content and methodology (i.e. gender equal research design) have to be addressed to achieve better results.[4]

1.3.2 Science literacy

The term "science literacy" has been used for almost half a century, since Paul DeHart Hurd introduced it in 1958 (Hurd, 1958). At the beginning of the scientific discourse, the general underlying assumption was that science is too complicated for the general public (lack of public understanding). In the 1990s and early 2000s, public concerns over research and innovation intensified. There was growing demand by European citizens to be better informed about, and involved in, science and technology, and this contributed to a growing political awareness of citizen participation in science and technology. This resulted in a remarkable cultural turn. While old strategies emphasised the management of raising public awareness and education about science, new strategies called for citizen engagement and dialogue in science and technology (see also section 1.3.5).

The change in approach from educating the scientifically "illiterate" public to involving civil society and citizens in science and technology development indicated growing awareness of a 'new' mode of scientific knowledge production. In this mode, knowledge is produced in joint cooperation between experts and non-experts. The knowledge and concerns of citizens are seen as being essential for the production of scientific knowledge (Bucchi, 2008). In particular, this is true for knowledge production addressing the grand societal challenges, like climate change and the demographic or digital transformation. Variations of the discourse can be observed in discussions on open innovation, user-driven innovation, open science, and transformative science (Schneidewind et al., 2014).

As summarised by Holbrook and Rannikmae (2009), the evolution of the "science literacy" discourse is the shift from an "*approach in which facts and skills are paramount, towards the inclusion of issue-based teaching, the need to go beyond scientific problem-solving to encompass socio-scientific decisions making, and the recognition that scientific literacy relates to enabling citizens to effectively participate in the real world*" (ibid., 2009, p. 279).

The meaning and location of "science literacy" in the European policy discourse has evolved over time. It can be interpreted as a subset of the policy discourse on

[4] International Conference "Ready for Dialogue" on the Gender Dimension in Science and Research in November 2015 at Berlin. http://www.ready-for-dialogue.de/

knowledge and education linked to the EU's paramount political objective of attaining a transition towards a knowledge-based economy (European Council, 2000a). The education system in Europe has to respond to this challenge (Article 165 of the Lisbon Treaty). The Treaty on the Functioning of the European Union states in its preamble that the EU is "*determined to promote the development of the highest possible level of knowledge for its public through a wide access to education*" (European Union, 2008, p. 49). At the international level "quality education" is the fourth of the Sustainable Development Goals (SDGs) (United Nations Development Programme (UNDP)). The life-long learning concept (European Parliament and Council of the European Union, 2006b) expanded the range of addressees also in the context of a broader discourse on Open Science.

Another stream of discourse can be observed in the transition from STEM (Science, Technology, Engineering and Mathematics) to STEAM (Science, Technology, Engineering, Art and Mathematics) – including all other disciplines (European Commission, 2015d, p. 15). In order to set up a framework for science education for responsible citizenship, "*Science education should focus on competences with an emphasis on learning through science and shifting from STEM to STEAM by linking science with other subjects and disciplines*" (European Commission, 2015d, p. 9).

Today, it is generally accepted that European citizens have the right to be informed about the benefits and risks of innovation and should be able to participate in research and technological development. Science education and the resulting "science literacy" could support the empowerment of citizens to exercise these rights.

In practice, "science literacy" can be created through different mechanisms:

- Science education,
- Science communication and
- Co-production of knowledge.

The main thrust in the SaS and SiS programming was primarily on science education and communication as the basis for "science literacy". Co-production of knowledge played a minor role in the programming for "science literacy", and was more present in related SaS and SiS dimensions such as "civil society and citizen participation" and "open access".

1.3.3 Science and ethics

The ethics in science and research discourse has a history reaching far back in the past of European public policy in relation to shared moral values. However, in the European treaties there is no direct mention of ethics relating to scientific progress and emerging technologies. The European Treaties refer to the Charter of Fundamental Human Rights, which is the framework for the ethics in science and technology debate in the EU.

In the late 1990s, an Advisory Board on ethical issues in science, research and technology was established, mandated by the European Commission's Directorate General for Research and Development. This board was later transformed into the European Group of Ethics (EGE), an independent advisory group reporting to the President of the European Commission. The aim of this group was to advise the European Commission on ethical questions relating to science, research and emerging technologies. The general task of the EGE was to identify, define and carry out research on ethical questions raised by developments in science and technologies, and to provide inputs to European policy making.

In June 2001 the European Council of Ministers invited Member States (MS) and the European Commission to start a dialogue on ethical, legal and social issues in science, research and emerging technologies. The initiative resulted in the *Science and Society Action Plan* and a proposal to implement a thematic area on science and society aspects in the European Research Framework Programmes. Already in Framework Programme 4, ethical, legal and social (ELS) aspects in science and technology were included in the general research agenda. In FP6, ELS aspects were further specified in the research agenda giving birth to the SaS specific programme.

At MS level, similar trends of institutionalising ethical advisory bodies to advise national governments on ethical issues of science, research and emerging technologies could be observed in the late 1990s. Nearly every Member State introduced a national advisory committee on bioethics and ethics in medicine and genome research. At a later stage, other national science ethics advisory groups were established due to an increase in ethical concerns about emerging technologies, for example on nano-ethics.

Despite the implementation of a practice prospectively assessing novel bioscience and emerging biotechnologies in institutional structures (e.g. national bioethics commissions or the European Group on Ethics in Science and New Technologies), there is still a high demand for an ethical analysis and assessment in upcoming novel technology areas. These include the progressing field of human enhancement technologies or regarding robotic autonomous systems for caring for the elderly by human-like robots.

It is widely acknowledged that ethical questions in the discourse on science, research and emerging technologies should receive early attention. Meanwhile ethical debates tend to flourish even when research and development in new technology areas are still at a very early stage. Such debates often combine the ethical assessment of today's technologies in the development and engineering phase, with reflections on future technology options.

Ethics research as a "preparatory" and "forward looking" action, is dealing with speculative science issues and technology options. This research is highly relevant, in particular when ethical debates in pluralistic societies tend to disperse into many directions due to different belief systems and world views. A good example is the ethical debate on human enhancement technologies. On the one hand, there are strong ethical concerns to enhance the human body through technology. On the other hand, some technologies are already commonly applied in modern medicine.

In ethics research, it is relevant to communicate and coordinate amongst different stakeholders, their belief systems and plural opinions, and mediate pluralistic views and perspectives.

Under the FP6-SaS and FP7-SiS programmes, a number of projects were funded in order to strengthen the relationship between ethics and science, and ethics in various emerging science and technology areas.

1.3.4 Governance and scientific advice, RRI

Governance of science and research is a policy issue under constant debate with a multitude of approaches and concepts changing over time. With science and technology progressing, new benefits and risks emerge and contribute to a constantly changing agenda. In the 1990s, research and innovation in biotechnology, human genome research, nano-technologies, human enhancement and other areas raised concerns in society and policy making regarding ethical, legal and social issues. This situation indicated the need to address them in the governance of science and technology.

Although there are regional differences, there is an overall pattern of framing responsible research and innovation (RRI) as an evolution of the governance of research. This trend can be observed not only at the EU level, but also at the national and regional level. Several Member States[5] launched national RRI programmes and initiatives and implemented intergovernmental working groups or coordination platforms for RRI. In

[5] For example, the Netherlands, Austria, Germany -the German federal states of Bavaria, Berlin, Baden-Württemberg-, and Spain -the Spanish autonomous regions of Cataluña and the Basque Country.

Austria, for example, the RRI Platform[6] is a partnership between different Ministries, the Research Promotion Agency (FFG) and the Austrian Science Fund (FWF), research institutions and other intermediary organisations such as Open Science.[7] In Spain, the regional government of Cataluña has implemented a RRI platform.[8] Another prominent example is the RRI discourse in the Netherlands where the National Research Council (NWO) set up a research and innovation programme dedicated to socially responsible innovation (called "MVI"). At the level of individual science institutions, large Research and Technology Organisations (RTO), such as Fraunhofer in Germany or CNRS in France, have their own RRI projects, programmes and institutions (as in the case of Fraunhofer which institutionalised an RRI centre).[9] In other world regions, RRI is framed in a slightly different manner. For example, in India the discourse on responsible research and innovation refers to the terms of access, equity and inclusion with regards to science, technology and innovation. The Indian government's 12th five-year plan (2012-2017) envisages science and technology as making an important contribution to "faster, sustainable and more inclusive growth" with special emphasis given to equity in development.

Today, the RRI agenda is framed as a major science and technology governance approach to align scientific research, technological development and innovation actions with societal and ethical challenges in combination with other socio-economic concerns, such as economic growth, jobs, wellbeing, and competitiveness.

The European Commission published in 2002 its guidelines on the collection and use of expertise for "*improving the knowledge base for better policies*" (Commission of the European Communities, 2002).

The SiS programme contributed to the interaction between science and politics with measures such as the creation of expert groups, a seminar with parliamentary officers for science and technology, pairing schemes for scientists and Members of the European Parliament, integrated assessment methods for measuring societal impacts of emerging scientific and technological developments, social impact assessments of research, and the Monitoring Activities on Science in Society (MASIS) project. However, since the 2013 WP, the SiS programme was more focused on specific measures relating to RRI such as research on the economic benefits of RRI, RRI in an industrial context, the establishment of an expert group on RRI, a Eurobarometer survey on RRI, the development of training activities and a dissemination toolkit on RRI.

1.3.5 Civil society and citizen participation

As in the related discourses on "Open Science" and "science literacy", several societal, technological, political and economic "streams" have shaped the "civil society and citizen participation" (CSCP) discourse evolution from a concept of "science communicating to the audience" towards a "concerned and informed citizenship which actively takes part in shaping the science and science policy". At present, in Horizon 2020, CSCP is labelled as "Public engagement in Responsible Research and Innovation" and is understood as "*co-creating the future with citizens and Civil Society Organisations (CSOs), and also bringing on board the widest possible diversity of actors that would not normally interact with each other, on matters of science and technology*".[10] Nevertheless, "*even after several decades of political, academic and broader societal attention […] the issue of public engagement has in no way become trivial, and there is no homogeneous European model* […]"(Mejlgaard et al., 2012).

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[6] https://www.rri-plattform.at
[7] http://www.openscience.or.at
[8] http://www.acup.cat/en
[9] http://www.cerri.fraunhofer.de
[10] https://ec.europa.eu/programmes/horizon2020/en/h2020-section/public-engagement-responsible-research-and-innovation

A modern CSCP discourse has emerged in various discourse streams, focused on the following main themes:

- Self-conception of science that always needs a discussion of research findings by the widest and most informed audience possible. Widening the concept of science communication to a process of reciprocal mutual information exchange process is a logical consequence of the self-conception of science;
- Technological advancements in certain scientific disciplines, such as genetic engineering or artificial intelligence, have underlined the need for a wide and open debate between science, civil society and policy makers on the ethical limits of science;
- Exponential increase in technological progress in information and communication technology has enabled huge progress in science, but also the possibility to share scientific findings, allowing and demanding almost real-time communication between affected target groups;
- Increased funding of science has multiplied the volume of scientific activities and outputs, which is accompanied by the increased need to justify public spending on science and research.

Those streams have continuously driven and challenged the discourse on connecting science and non-science and required it to constantly find new answers to old questions, such as:

- Who in particular is connected and who actually represents the science and non-science spheres? Previously, science and non-science actors were distinguished based on their link to science or to civil society. This understanding has become more diverse, for example civil society is actually civil societies (plural) including multi-actor entities such as CSOs, individual citizens, and other formations with thoroughly divergent motivations;
- By which means are information flows connected? The connection between science and non-science has evolved from a one-way and information-pushing approach, to a reciprocal two-way, interactive feedback and democratic exchange of information. This evolution was accompanied by a change of communication means;
- For which purposes are science and non-science connected? Traditionally, communication from science to society included insights relating to scientific advancements and associated benefits. This science communication, in the first stage, contributes to justifying public funding of research and innovation activities and increasing trust in science, research and innovation policy. This purpose has faced several development stages and has resulted in the creation of a mutual and enhanced understanding of the problem, enabling an informed debate, collective agenda-setting, viability of policy options and, lastly, better policy making.

1.3.6 Open access, open science

The concepts of the dimension "Open Access, Open Science" (OAOS) have constantly evolved. At an early stage, the focus was primarily on making the dissemination of research results more transparent and accessible, firstly to science itself and then to the general public. Amongst the most crucial milestones of the discourse development, there were three statements in reference to the open access movement: (i) the 2002 Budapest Open Access Initiative; (ii) the 2003 Bethesda Statement on Open Access Publishing; and (iii) the 2003 Berlin Declaration on Open Access to Knowledge in Science and Humanities. The idea of open access to science has further evolved and now includes not only access to research results in terms of scientific publications (via the so-called "golden", "green" or "hybrid" roads),[11] but also access to the data and processes needed to arrive at these results. Hence, its current state of evolution is shaped by a more general conceptualisation of an open science as in the related discourse on "science literacy".

OAOS has been explicitly framed by the challenge of making use of knowledge in a knowledge-based economy, and thereby to connect scientific and non-scientific actors. For example, in the documents regarding the creation of the ERA following the Lisbon Agenda, it was stated that "*we are now entering […] the century of science and technology. More than ever, investing in research and technological development offers the most promise for the future.* […] *Without concerted action* […] *Europe might not successfully achieve the transition to a knowledge-based economy*" (Commission of the European Communities, 2000a).

The discourse on OAOS has emerged in various streams, revolving around the following themes:

- It is inherent to the self-conception of science that science needs to be open in order to be confirmed and perpetuated following the idea that "open inquiry is at the heart of the scientific enterprise" (Boulton et al., 2012);
- Increasingly severe economics of scholarly publishing activities put a critical perspective on academic reward and reputation systems;
- Exponentially increasing computer power, digitalisation, and connectivity have led to a greater availability of data and data sharing;
- Research progress in certain scientific disciplines and technological advances and ground-breaking developments in natural sciences were achieved due to technological innovation; OAOS has emerged as a possible answer to dealing with the accompanying critical issues such as ethical concerns and a critical public discourse on the role of science;
- Science as a public asset has become part of an open debate on the accountability of publicly funded research;
- Regarding positive feedback on OAOS, a better-informed public has demanded a more open and informed debate.

In the EU, the principle on which the OAOS activities are grounded under FP7 (SiS) was freedom of research. This should be understood as both the freedom to conduct research and freedom to access knowledge.

1.4 Policy context

From the Lisbon Strategy to Europe 2020, knowledge production, the competitive use of knowledge, education, scientific research, technology, and innovation were acknowledged as the major driving forces of economic growth and competitiveness. In FP6 and FP7, the Work Programmes and calls on science and research, technology and innovation have evolved. Socio-economically relevant dimensions were increasingly taken into consideration across all FP thematic areas. This applies to both the content of science and research, and the exploitation and accessibility of science and research results.

The social dimension of science has also been integrated in the ERA and the Innovation Union Flagship initiatives that address, amongst others, mutual trust between science and society. It has also been integrated in other Research strategies at EU and MS levels

[11] In the "golden" road, scientific publications are directly available to all interested readers, in the "green road" open access is guaranteed through the possibility of publishing pre-prints of traditional scientific journals, and in the "hybrid" road authors pay a traditional scientific journal for making their individual contributions openly and freely accessible.

in terms, for example, of gender equality in research and innovation and improvements in the dissemination and exploitation of research results.

Starting with the Science and Society Action Plan in 2001, followed by the subsequent FP6-SaS and the FP7-SiS programmes, the discourse on the integration between science and society evolved at different policy levels and hybrid fora (Callon et al. 2009). In recent times, the science/society issues have been introduced at all policy levels. The benefit and power of the European Science and/in Society programmes is to integrate and coordinate them.

Even though the European Commission has been consistent in promoting research and innovation, a "cultural shift" can be observed. This is particularly the case with regards to science and society interaction in the ERA. Preferences and priorities have shifted over the past 15 years. The objective of stronger public engagement, for example, with the new relationship between European citizens and science and technology, is emphasised more today than in the past. This "cultural shift" is also expressed in the better regulation agenda of the European Commission. The Better Regulation Toolbox[12] specifies that scientific foresight "*connect[s] research and science activities to societal challenges by strengthening the engagement of stakeholders and citizens in policymaking*." (European Commission 2015a, p. 14).

The opening of science towards society is further emphasised by other policy documents such as Commissioner Moeda`"3 O's" strategy (Open Innovation, Open Science and Open to the World): "*The research process of the future will be global, networked and open. Many more actors will take part in different ways and the traditional methods of organising and rewarding research will also see many changes*" (European Commission, 2016b, p. 55).

The Rome Declaration on Responsible Research and Innovation, as well as the European Council meeting of December 2014, commended the principles of the Rome Declaration: "*excellence today is about more than ground-breaking discoveries: it includes openness, responsibility and the co-operation of knowledge with civil society*" (Science With and For Society Advisory Group, 2016, p. 5).

In May 2016, the European Council recognised the "on-going transformation and opening up of science and research, referred to as "open science", affecting the modus operandi of doing research and organising science". The Council considered that: "*assessing scientific quality should be based on the work itself and be broadened to include an assessment of the impact of science on society at large, while the current focus is on indicators based on impact of journals and publication citation counts*" (Council of the European Union, 2016, p. 6).

[12] Complementing SWD (2015)111.

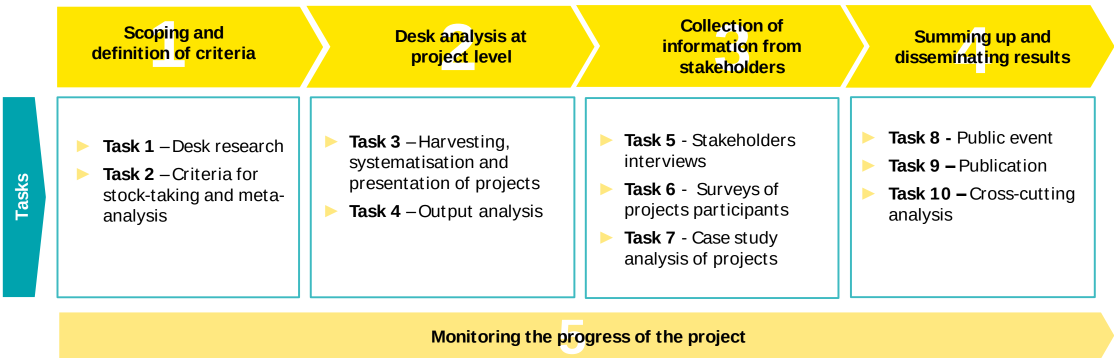
2 METHODOLOGICAL FRAMEWORK

2.1 Overview of the methodological process and approach

The study consisted of the following phases and related tasks:

1. **Scoping and definition of criteria**:
   - *i)* developing understanding of the SaS and SiS programmes through desk research (Task 1),
   - *ii)* defining an analytical framework for the study (Task 2);
2. **Desk analysis at project level**:
   - *i)* Collecting, systematising, and presenting data from all SaS/SiS projects and from two samples of projects with SxS content conducted in other parts of FP6 and FP7 (Task 3),
   - *ii)* analysing data through output analysis in order to provide preliminary answers to specific evaluation questions (Task 4);
3. **Collection of information from stakeholders**: aimed at integrating information and data collected via desk and field research through
   - *i)* stakeholder interviews (Task 5),
   - *ii)* surveys addressed to project participants and selected experts (Task 6),
   - *iii)* case studies assessing in detail the different results and impacts of SaS and SiS projects (Task 7);
4. **Summing up and disseminating results**:
   - *i)* disseminating the results of the study through a public event (Task 8) and the preparation of project fiches, best practices, and lessons learned (Task 9);
   - *ii)* answering all evaluation questions through a cross-cutting analysis (Task 10).

Figure 4 - Overview of the evaluation process



Source: Authors' elaboration

2.2 Evaluation framework

The study addressed three levels of analysis: project, programme, and (other) policy. Different types of analysis, tools and techniques - as defined in specific evaluation grids - were used to answer the evaluation questions relevant to each level. The following section provides a summary for each level of analysis.

2.2.1 Evaluation framework at project level

Analysis at project level focused on the effectiveness and contribution of the projects to the overall programme and policy goals. Most of the evaluation questions aimed to identify the link between the different levels of analysis and assessing the contribution of project results to the overall objectives. Overall, the study addressed nine evaluation questions covering the following topics at project level:

- **Relevance of projects**, in terms of awareness (as self-reported) of project coordinators/participants of the link between their project and the programme objectives and/or of other relevant EC policy objectives (i.e. SaS Action Plan, ERA, Innovation Union);
- **Effectiveness of project implementation**, in terms of achievement of the project-specific objectives defined in the Description of Work (hereinafter referred to as "DoW"), other SaS/SiS activity lines/programme objectives, and dissemination of the project results;
- **Best practices**, in terms of path-breaking advances and success factors and cross-thematic partnerships with other parts of the Framework Programme.

2.2.1.1 Projects analysed

The analysis was performed on:

- All 344 projects financed by the programmes Science and/in Society (hereinafter referred to as "SxS");
- A sample of 120 projects outside SxS programmes dealing with SxS related issues (hereinafter referred to as "SxS related");
- A sample of 120 projects financed by other FP6 and FP7 programmes and not related to SxS issues (hereinafter referred to as "FP other").

The two samples were extracted from a pool of projects identified using semantic distance techniques and the analysis of project documentation, as further described in Annex 1: Methodological Note.

The latest available information at project level gathered from the eCorda, CORDIS, and OpenAIRE databases was complemented by information gathered from stakeholders (through interviews and surveys) and additional web searches, including project websites.

Each analysed project was linked to one of the six identified dimensions.

All information was consolidated in a relational dataset (see Annex 1: Methodological Note) and was then used to draft project fiches including:

- Basic information on the project (starting/ending date, funding, call, area and activity);
- Project context and objectives – describing the main goals of the project, the strategic needs and the background of its development;
- Project results and outcomes – retrieved mainly from desk research;
- Main achievements of dissemination activities implemented alongside the project;
- Information on project output/impacts;

- Participants and research teams – indicating Member States and third countries involved and presenting the structure and composition of the team (when available);
- List of project deliverables and related publications;
- List of the main sources used to draft the project fiche.

The project fiches have been uploaded to an online **dashboard** and enriched with inputs from the surveys, the interviews, and the desk research. The online dashboard was launched together with the survey.

2.2.1.2 Analytical tools

Various tools were used for the analysis at project level, as described below.

Composition analysis

The composition analysis had two objectives:

- To compare SxS projects with projects in the other samples, in order to identify their specificities;
- To compare organisations participating in SxS projects with organisations participating in other projects of the other samples.

The analysis relied on descriptive statistics relating to:

- Project size and geographical coverage;
- Participation patterns;
- Team composition.

Moreover, collaboration patterns were examined through social network analysis.

All analyses were undertaken at both aggregate level and per dimension, in order to analyse differences and similarities between dimensions.

Output analysis

The aim of the output analysis was to capture the impacts of each project. It focused on both the potential and the actual impact.

a) Potential impact

The potential impact was measured by the following indicators that scientific literature has identified as being related to the actual impact of a project on the scientific, social, and policy debate:

- **Network centrality**: referring to FP6 and FP7 network global centrality ("*betweenness*") of each organisation;
- **Scientific attractiveness**: based on the number of actors (belonging to the University of Leiden Ranking) participating in the projects and their position in the ranking positions;
- **Business attractiveness**: based on the number of actors belonging to the EU Industrial R&D Investment Scoreboard Ranking participating in the projects and their position in the ranking (EU top 1000 companies ranked by R&D);
- **Participation of CSOs**: to capture the potential of a project to influence societal debate thanks to the involvement of actors that can support a better exchange between the scientific community and users/citizens.

b) Actual impact

The actual impact was measured by indicators capturing the following project impacts:

- **Scientific impact**, concerning the number of scientific publications and their quality in terms of impact factors of the journal and of citations (google scholar).

The main sources of information were the titles of publications and journals available in OpenAire for FP7 and, in some cases, in CORDIS for FP6 (in this case, the information was manually retrieved).

- **Social media impact**, to identify the presence of SxS projects on social media such as Facebook, Twitter, and LinkedIn, by looking at both the social media coverage (number and types of tools used), and the demographic and geographical coverage. The main objective of this analysis was to capture the echo, the online 'buzz', the visibility and influence that projects had in terms of number of conversations on social and digital media. Social media monitoring and web listening tools were used to assess this impact.
- **Institutional and organisational impact**, to identify if and how institutional or organisational changes occurred within participating organisations. The analysis was based on replies to the survey and the analysis of final reports, websites, and other documents available at project level.
- **Policy impact**, looking, for instance, at the involvement of project participants in working groups at EU level; the creation of new governance models for research activities; the influence of the project on EU policy debate; and the influence of the project at national policy level.

Case Studies

On the basis of the CORDA database and the results of the output analysis, a total of 120 projects from the FP6 and FP7 programmes were selected as case studies. The Case studies were based on the analysis of project proposals, deliverables, reporting and, where possible, on updates provided by interviewed project coordinators and participants.

The 120 case studies were selected from a representative sample covering 20% of the SxS projects (i.e. around 60 projects) [13] and a sample of 60 "SxS related" projects (see Annex 1: Methodological Note for details on the sampling strategy).

An in-depth analysis of the impacts of the case studies was performed to highlight the differences between the range and degree of impacts of SxS projects and their "SxS-related" counterparts.

2.2.2 Evaluation at programme level

Overall, the analysis at programme level aimed to evaluate the extent to which the SaS and SiS programmes achieved their objectives both in terms of specific programme objectives and Science and Society Action Plan objectives.

Overall, the study addressed 11 evaluation questions at programme level, covering the following topics:

- The evolution of the programme;
- Programme coverage;
- Impact of the programme;
- Utilised tools and approaches.

To answer the specific evaluation questions, information was collected via secondary sources (e.g. literature review and content analysis of the WPs) and then integrated with interviews and data retrieved from the database of projects, the output analysis, the surveys, and the case studies.

[13] The selected SxS sample was representative of all SxS projects in terms of size, geographical coverage and EC financial support, as well as thematic dimension, call, and instrument. Projects that had been already analysed in previous evaluation studies were excluded.

Finally, the evaluation at programme level also assessed the aggregated impact of SaS/SiS programmes on the policy debate. The European Parliament (EP) questioning analysis was used as a proxy for policy-making activity at EU level. The analysis aimed to assess whether and to what extent the SxS dimensions were represented in the EP debate on science related issues over the last two decades (from 1999 – today).

To do so, the research team compared the evolution of the keywords of projects with the political debate within the European Parliament (EP), through natural language processing techniques, and assessed whether and to what extent the SxS dimensions were represented in the EP questioning. More specifically, for the EU political debate, the research team analysed the text of EU parliamentary questions, which were available on the website of EU Parliament,[14] and checked if the topics of the EP questioning had been influenced by SxS activities.

2.2.3 Evaluation at 'other policy' levels

The study compared (benchmarked) SxS projects and programmes with FP6/FP7 programmes, activities and projects showing SxS aspects. Furthermore, benchmarking was carried out with other projects where SxS aspects were not integrated with regards to the achievement of the stated objectives and the range and degree of their impacts. The evaluation also took into account similar activities carried out at national level by MS, non-EU R&I-intensive countries (including the US and Japan) and the impact of SxS projects and programmes on the international (non-EU) policy context.

Overall, the study addressed 13 evaluation questions at "other policy" level, covering the following topics:

- Coverage of SaS-SiS aspects in FP6 and FP7;
- Impacts of FP6 and FP7 projects achieving SaS-SiS objectives;
- Integration of SaS-SiS activities in FPs;
- From Science and-in Society to Horizon 2020;
- The contribution of SaS-SiS programmes to national activities;
- The EU added value of SaS-SiS.

2.3 Main tools for stakeholder consultation

Table 1 describes the main tools used for stakeholder consultation.

Table 1 - Tools for data collection

Tool	Description
Surveys	The fieldwork data collection included two surveys: • One covering all SaS and SiS projects, targeted to a sample of participants and all coordinators of those projects; • One covering SxS-related projects and targeting a sample of participants and all the coordinators of those projects. The surveys were launched on the 25th May 2016 targeting 1,131 stakeholders. On average, for both surveys, a 17% response rate was reached which is similar to the response rate of previous evaluation studies on SxS programmes. In terms of the representativeness of the projects in scope, the research team received responses covering 24% of the SaS projects and 37% of the SiS projects from both project coordinators and project participants. Responses were then compared with the overall distribution of the SxS

[14] http://www.europarl.europa.eu/plenary/en/parliamentary-questions.html#sidesForm.

	projects across the six dimensions of analysis.
Interviews	Interviews were performed in two different rounds: the first round aimed to frame the stock-taking and meta-analysis study and support the design of the survey, and a second round aimed to complete the analysis of the programmes and examine the list of horizontal issues. Interviews targeted three categories of stakeholder: (i) policy makers and EC Officials; (ii) project coordinators and participants; (iii) independent experts from the six dimensions of analysis and experts from the SxS programmes. In total, 94 semi-structured interviews were conducted between March and August of 2016.

Source: Authors' elaboration

3 SAS AND SIS PROGRAMMES MAIN FINDINGS

The following sections present the main results of the analysis undertaken at project level.

3.1 Composition analysis of projects

3.1.1 Analysis of projects size and geographical coverage

The SxS projects were compared with their benchmark samples in terms of:

- Project size, including (i) Number of participants and (ii) Amount of EU financing support;
- Geographical coverage.

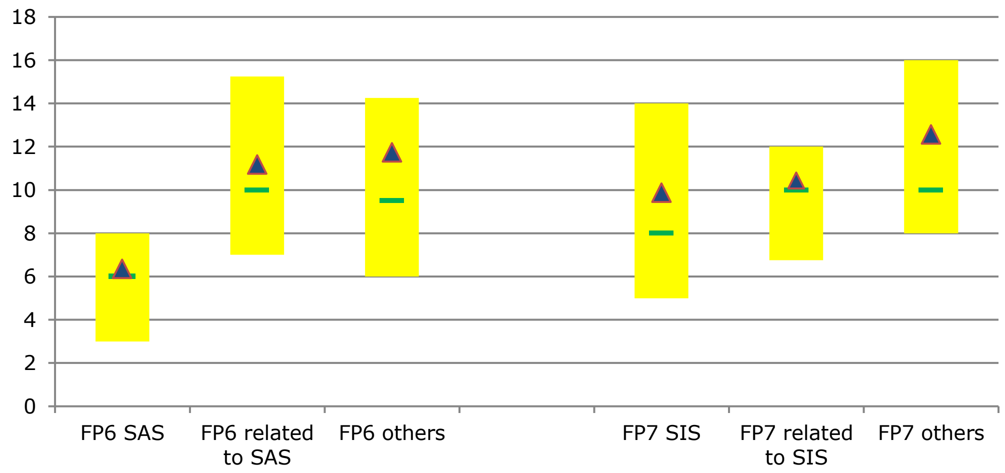
A synthetic measure was provided for each sample of projects and each dimension. These measures were then compared to identify statistically (i.e. *t-test*) significant differences between SxS projects and their benchmark samples.

3.1.1.1 Project size

Number of participants

SaS and SiS projects are on average smaller than their benchmark samples in terms of number of participating organisations per project (Figure 5).[15]

Figure 5 - Average number of participants per project

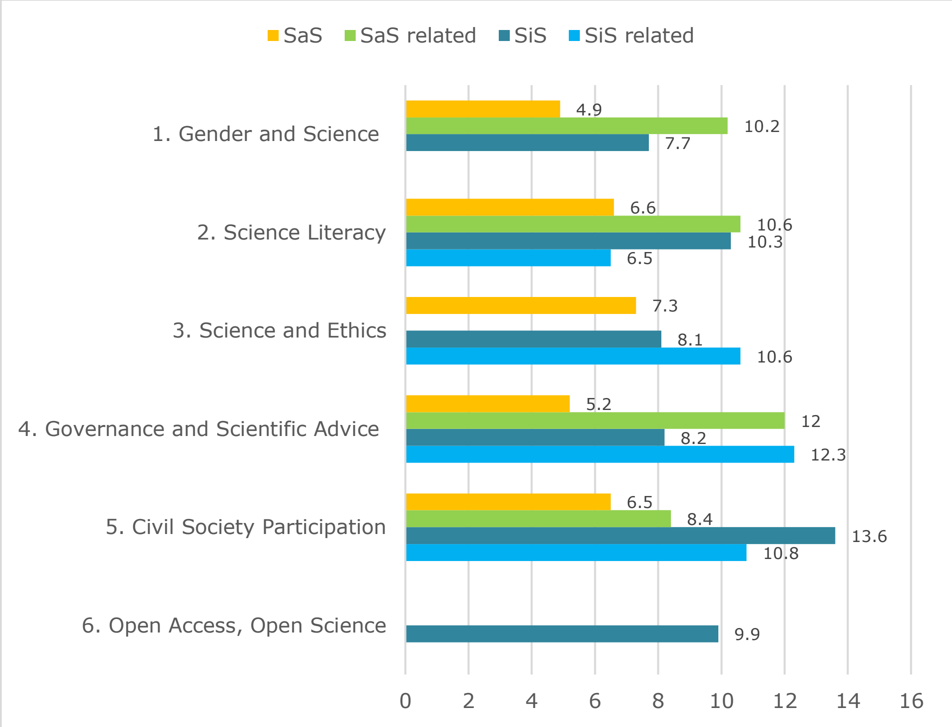


Source: Authors' elaboration on eCORDA data

The average number of participants per project varies considerably when analysing the projects' average size per dimension: projects relating to "Gender and science" and "Governance and Scientific Advice" were the smallest compared to the benchmark samples (Figure 6). However, in all dimensions there is an increase in the project average size from SaS to SiS, especially with regards to "Civil society participation" projects (that doubled, passing from 6.5 to 13.6) and "Gender and science" projects (passing from 4.9 to 7.7).

[15] This result is also confirmed by the analysis of quartiles and medians which are less sensitive to outliers.

Figure 6 - Average number of participants per project, by dimension



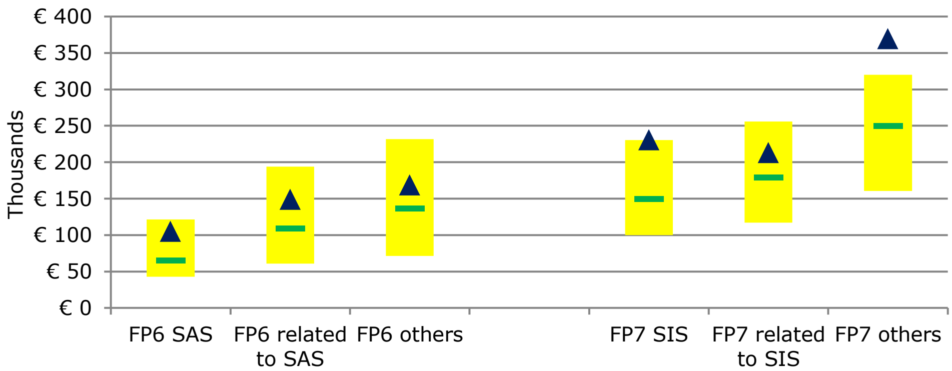
Source: Authors' elaboration

EU financing support

A similar trend can be observed in the average funding per participating organisation. In SiS, the median funding per participating organisation tripled in comparison to SaS. A smaller increase can be observed in the case of "SxS-related" projects passing from FP6 to FP7 (Figure 7).

In addition, under the SiS programme, the distribution of funding became more similar to the other FP7 projects in terms of both size of the funding per project participant and variety of funding size.

Figure 7 - Averages and main quartiles of EC financial support per project/participant (€)

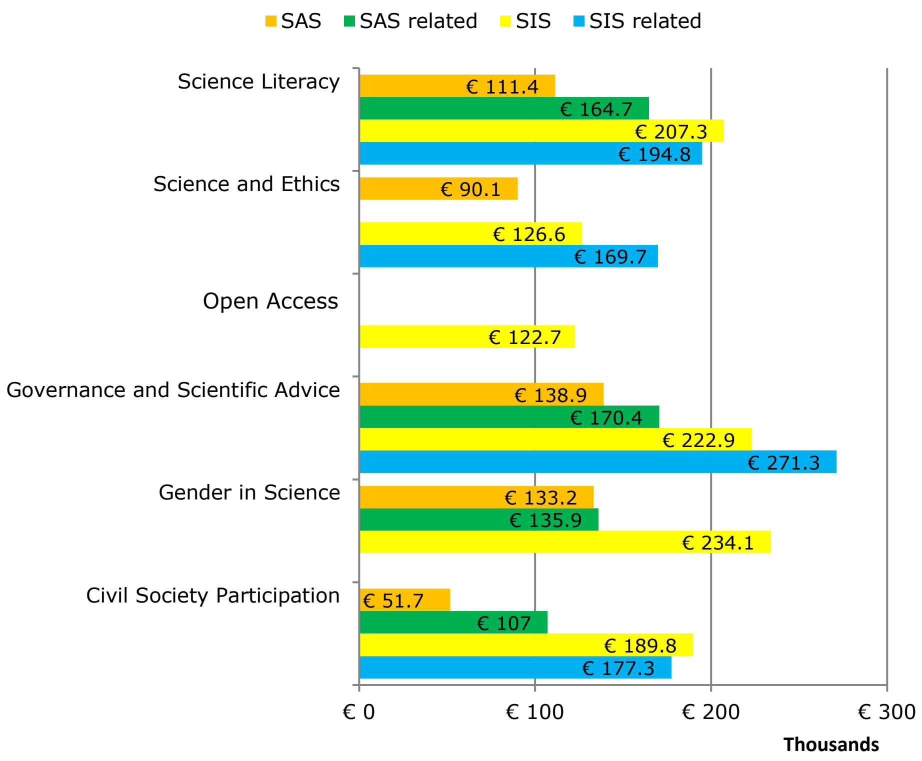


Source: Authors' elaboration based on eCorda data

The funding patterns change when looking at the different samples **per dimension** (Figure 8).

- Overall, projects linked to "governance and scientific advice", "gender and science" and "science literacy" received the highest average funding per participant, in both FP6 and FP7.
- SaS projects in all dimensions received lower funding per participant compared to their benchmark samples. By contrast, SiS projects related to "science literacy" and "Civil society participation" received higher level of average funding when assessed against their benchmark samples.
- Average funding per participant significantly increased from SaS to SiS in the case of "civil society and citizen participation" and "science literacy" projects (respectively by four and two times), and to a lesser extent also for "science and ethics" projects.
- The lowest average funding per participant is observed for the projects related to "open access" under FP7 and for those relating to "civil society participation" under FP6.

Figure 8 - Average EC financial support per participant by dimension (€)

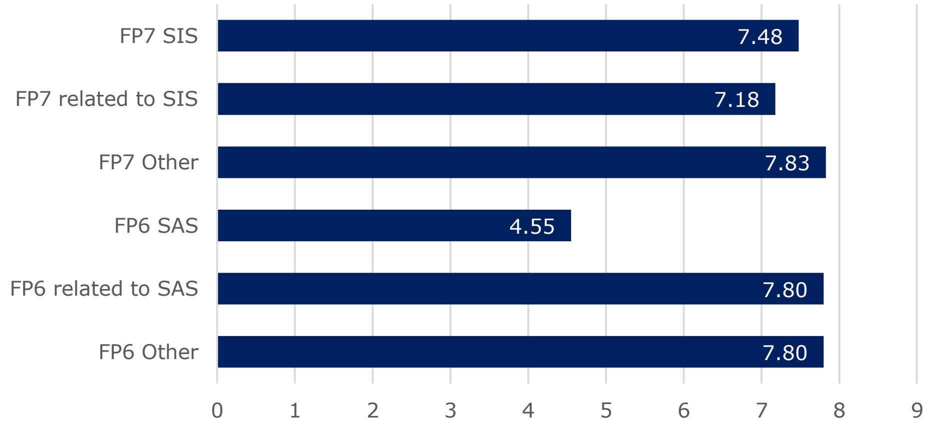


Source: Authors' elaboration based on eCorda data

3.1.1.2 Geographical coverage of projects in terms of number of participating countries

Figure 9 shows the average number of countries participating in the different samples of projects.

Figure 9 - Number of different participating countries



Source: Authors' elaboration on eCorda data

Overall, there is no statistically significant difference in the number of participating countries in the samples analysed under FP7. The only statistically significant difference is between SaS projects and their benchmark samples: FP6 projects related to SaS and FP6 other projects (both with a P-value smaller than 0.0001). Indeed, SaS projects involved a smaller number of organisations located in different countries.

This is also true when analysing the data per dimension: the average number of countries participating in SaS projects is lower when measured against benchmark samples (especially when considering the "gender and science" dimension). This difference has significantly decreased under FP7, when the average number of participating countries per project is similar in the different samples.

3.1.2 Analysis of participation and collaboration patterns

3.1.2.1 Participation patterns

In total, 1,075 organisations have participated in the SiS programme with an increase of 50.5% from SaS to SiS. Most of them participated in FP6 projects and, more specifically, in the SaS programme (Table 2).

Table 2 - SiS participants involved in previous FP projects

Type of participant	Number of SiS organisations participating in other projects	Share of SiS participants
FP6 participants	534	49.67%
SaS participants	225	20.93%
SaS related participants	155	14.42%

Source: Authors' elaboration

To analyse the types of organisations involved, the category "other" in eCorda was manually reclassified into two categories: "other" and "CSOs".

Figure 10 presents an overview of the types of organisations involved in the different samples. Overall, a large majority of SxS project participants are Universities (HES) and Research Centres (REC). However, a comparison with the benchmark samples shows that these types of organisations also very frequently participated in "SxS related" and "other FP" projects.

On average, compared to their benchmark samples, SxS programmes are characterised by a stronger presence of CSOs and a lower share of enterprises/private companies (PRC).

Figure 10 - Sectorial distribution of participating organisations

	CSO	HES	PRC	PUB	REC	OTH
SAS	13.6%	40.3%	11.6%	5.9%	19.6%	9.1%
SAS related	5.7%	37.7%	4.6%	5.6%	34.3%	12.0%
FP6 other	1.6%	41.6%	12.6%	3.0%	35.1%	6.2%
SIS	15.8%	37.1%	15.4%	11.2%	18.9%	1.7%
SIS related	7.7%	40.5%	19.5%	6.4%	24.1%	1.8%
FP7 other	2.4%	35.9%	28.7%	4.2%	27.1%	1.8%

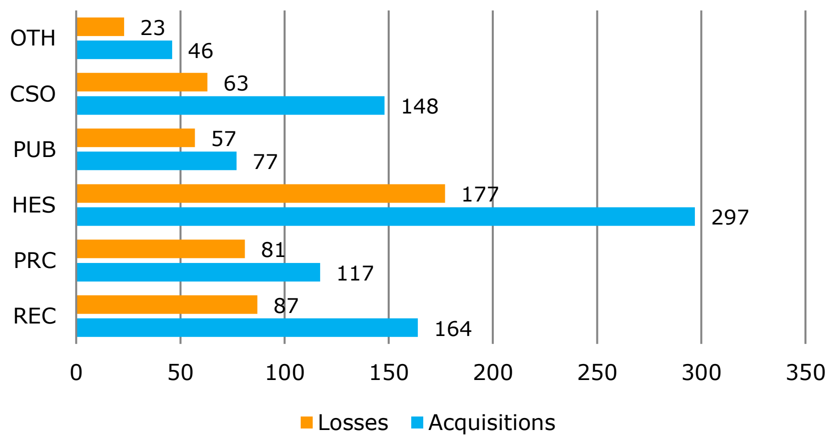
Source: Authors' elaboration based on eCorda data

The participation of public organisations and CSOs increased from SaS to SiS. In both SaS and SiS programmes, CSOs represent, on average, 13% of the participating organisations, which is higher than the average value in the "other" projects sample.[16]

Similar patterns can be observed when considering the type of organisations with coordinating roles. Higher and secondary education institutions tend to assume the role of coordinators (in 39% of the SaS projects and 44% of the SiS projects), followed closely by research centres (23% in both SaS and SiS projects). CSOs act as project coordinators in only 14% of the SaS projects and 11% of the SiS projects.

Finally, Figure 11 shows the organisations which participated in SaS but not in SiS ("losses") and the organisations which participated in SiS but not in SaS ("acquisitions"), per type of organisation. Overall, 488 SaS organisations did not participate in SiS and 849 SiS organisations did not participate in SaS.

Figure 11 - Acquisitions and losses from SaS to SiS



Source: Authors' elaboration based on eCorda data

[16] CSOs are usually classified in the eCorda database under the generic definition of "Other" organisations. The differences among the SxS programmes and the benchmark samples is statistically significant (at 1% level). Interestingly, also SxS related projects show a higher involvement of CSOs than the other FP projects (5.7% in SaS related and 7.7% in SiS related projects).

Although the overall number of participating organisations considerably increased, the sectorial distribution did not significantly change between SaS and SiS.

Focus on CSOs

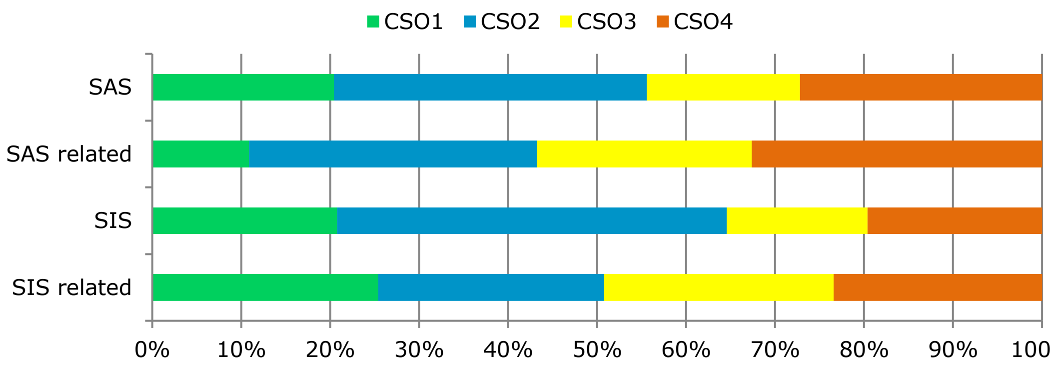
As mentioned above, in SaS and SiS programmes, as well as in SxS related projects, the number of participating CSOs was higher than in "FP other" projects (Figure 10). This is not surprising considering that the involvement of CSOs is expected to support a more participative research which can be more responsive to the needs of citizens and reduce the gap between science and society. SaS and SiS projects involved these organisations the most.

Due to this, the team has further investigated the participation patterns of CSOs. As there is no standard definition of a CSO,[17] the analysis relied on the following classification provided by the Vienna University of Economics and Business in the Study on network analysis of CSO participation in FPs (European Commission, 2017):

- CSO 1: the CSOs funded by individuals or non-profit organisations. The beneficiaries of their activities are citizens. This kind of organisations can be considered as the "core" CSOs in the very narrow sense;
- CSO 2: the CSOs funded by public authorities. The beneficiary of their activities is "society" in general (citizens, public, government);
- CSO 3: the CSOs funded by companies. The beneficiary is "society" in general, however these organisations may be considered as different from the CSOs funded by public authorities due to their different interests;
- CSO 4: the CSOs funded by companies, and with companies as the main beneficiary (this category includes industry associations).

The most involved CSOs in SaS/SiS projects were the publicly funded CSOs (CSO2), whose average relative participation increased from 35% in SaS to nearly 44% in SiS. Also, the not-for-profit organisations CSOs (CSO1) and the industry associations CSOs (CSO4) were particularly active in both SaS and SiS. On average, they accounted for 20% of the participation in each programme (Figure 12).

Figure 12 - Distribution of participation by type of CSO



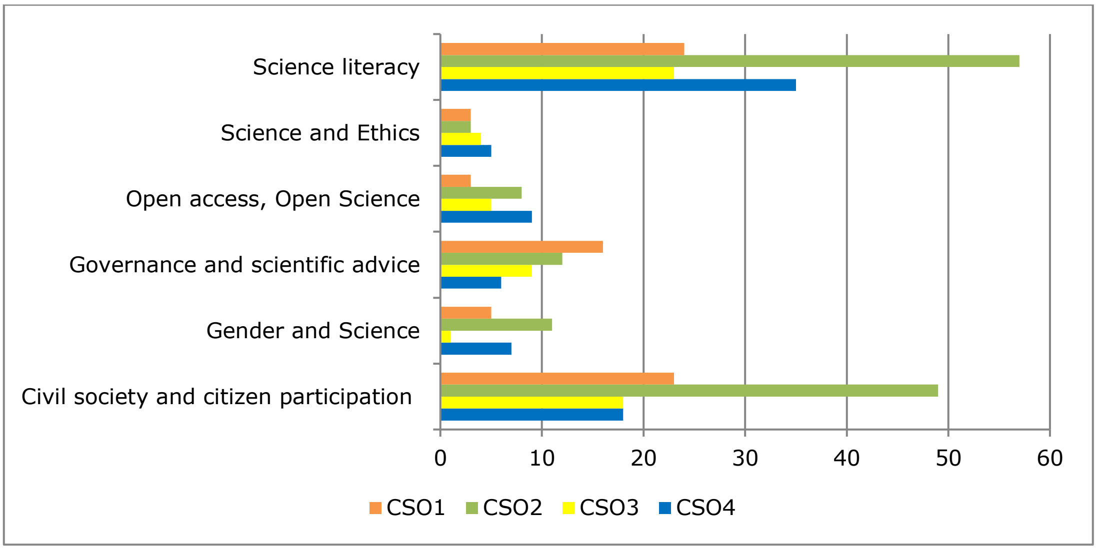
Source: Authors' elaboration based on eCorda data

Overall, 95 CSOs participated in SaS projects and 168 in SiS projects. Their participation varies depending on the specific dimension. As shown in Figure 12, most CSOs involved

[17] The EU's definition of CSO is 'Any legal entity that is non-governmental, non-profit, not representing commercial interests and pursuing a common purpose in the public interest' (https://ec.europa.eu/research/participants/portal/desktop/en/support/reference_terms.html).

in SxS programmes participated in projects relating to "civil society and citizen participation" and "science literacy"; in this case, the publicly funded organisations CSOs (CSO2) are prevalent. Several CSOs have also participated in projects relating to "governance and scientific advice". In this case the not-for-profit organisations CSOs (CSO1) were prevalent.

Figure 13 - Number of CSOs participating in SxS projects per dimension



Source: Authors' elaboration based on eCorda data

3.1.2.2 Collaboration patterns

Analysis of the collaboration patterns shows recurring collaborations in FP6 and FP7. The following table shows the number of SiS collaborations between:

- Organisations that participated together in a SaS project;
- Organisations that participated in different SaS projects;
- Organisations that participated in a SaS project and organisations that participated in another FP6 programme.

Table 3 - Analysis of the influence of SaS collaborations in SiS

Type of collaboration	Number of SiS collaborations	Share of overall SiS collaborations (11,974)	Cumulative number of collaborations
Already established in SaS	182	1.5%	-
Between two SaS participants	1,265	10.5%	1,447 (12%)
With at least one SaS participants	4,820	40.3%	6,267 (52.3%)

Source: Authors' elaboration

More than half (52.3%) of the collaborations observed in SiS involve at least one organisation previously participating in SaS. However, almost all these collaborations are newly established: only 182 SiS collaborations had been already established in SaS (1.5%).

Finally, it is worth investigating whether previous collaborations in SaS played a role in establishing new collaborations in SiS. According to the network analysis undertaken, organisations tend to connect to a very central organisation (preferential attachment hypothesis). They also tend to establish collaborations with other organisations that are indirectly known. In particular, it is very likely that organisations start new collaborations with partners of their already established networks: in networks, triangles tend to close ("triadicity hypothesis").

Table 4 reports the number of new collaborations that were established between SiS organisations that used to have the same partner in SaS.

Table 4 - New collaborations between SiS organisations with SaS common partners

Programme	New collaborations with common SaS partners (1)	New collaborations relative to SaS (2)	Share (1)/(2)
SaS	1,206	11,792	10.2%

Source: Authors' elaboration

In conclusion, the analysis of collaboration patterns shows that the great majority of the collaborations observed in SiS are new. However, half of these new collaborations involve at least one SaS participant. Moreover, 10% of these new collaborations are established between organisations that had the same partner in SaS.

3.1.3 Analysis of the projects teams

The analysis of the project teams was performed based on the information included in the DoWs for the project.

The criteria used to qualify the team members are as follows:

- **Gender**: Female, male;
- **Seniority**: Junior (less than 4 years of experience); Average middle level (between 4 and 8 years of experience) and Senior (more than 8 years of experience);
- **PhD**: Whether the team member holds a PhD or not;
- **Background**: The type of education or major expertise of the team member, and namely:
  - Applied Sciences: Agriculture, Fisheries & Forestry, Built Environment & Design, Enabling & Strategic Technologies, Engineering, Information & Communication Technologies;
  - Health Sciences: Biomedical Research, Clinical Medicine, Psychology & Cognitive Sciences, Public Health & Health Services;
  - Humanities and Social Sciences: Communication & Textual Studies, Economics & Business, Historical Studies, Philosophy & Theology, Social and Political Sciences, Visual & Performing Arts;
  - Natural Sciences: Biology, Chemistry, Earth & Environmental Sciences, Mathematics & Statistics, Physics & Astronomy.

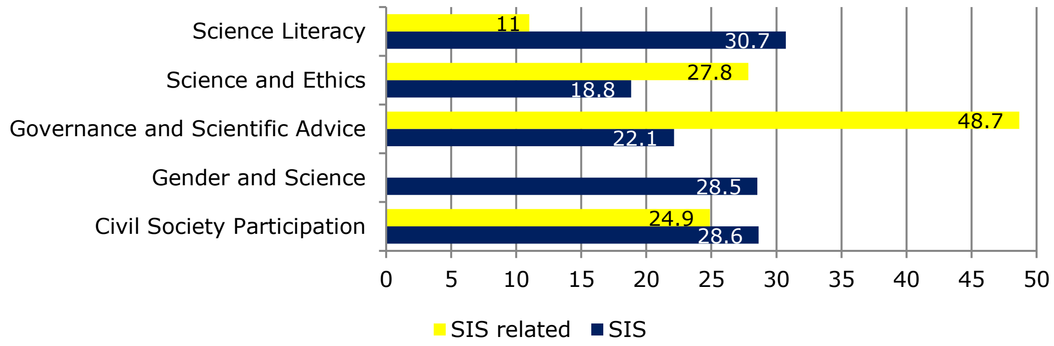
3.1.3.1 Team size: number of team members

The average number of team members increased from SaS to SiS, from around 10 people in SiS to around 20 people in SaS.

The difference in the size of the teams between SxS projects and their benchmark samples is not statistically significant when considering "SxS related" projects. However, it is statistically significant when considering "other" FP7 projects (the difference is significant at the 5% level, as FP7 projects are generally larger) and "other" FP6 projects.

An in-depth analysis per dimension shows the same pattern with a relatively small difference between SaS and "SaS-related" projects. The only noticeable difference is for projects relating to "gender and science" where SaS project teams are composed, on average, of 13 members while similar projects under other FP6 programmes include more members (approximately 24).

Figure 14 - Average team size per dimension in FP7



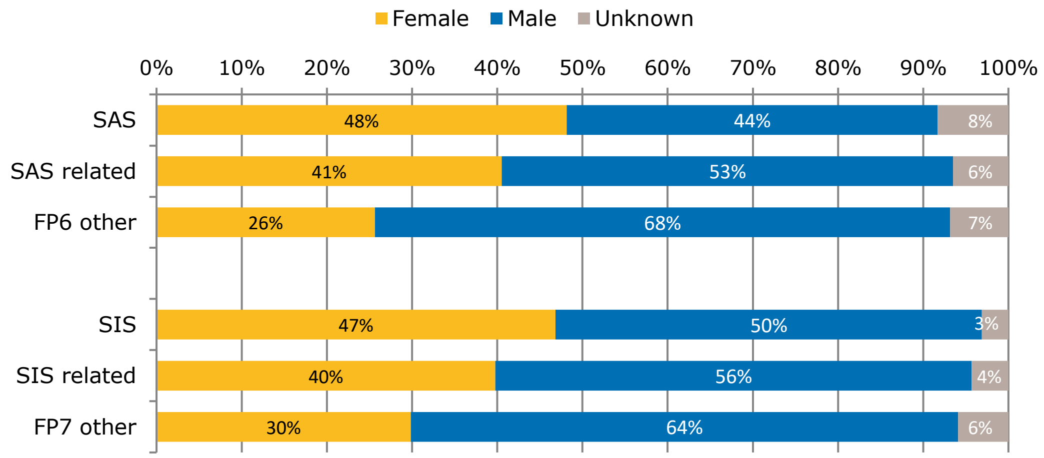
Source: Authors' elaboration on information in the DoWs

Differences in the number of team members are more evident in FP7, where SiS projects were usually larger than "SiS related" projects. For instance, under the "science literacy" dimension, SiS project teams were on average three times larger than "SiS-related" project teams (with the exception of "Governance and Scientific Advice" where "SiS-related" project teams were on average twice as numerous as the SiS ones).

3.1.3.2 Gender balance in projects research teams

The higher gender balance of teams is a distinctive feature of SxS and "SxS-related" projects compared to teams of "other" FP projects. As shown in Figure 15, on average, SaS and SiS projects were composed of a similar share of men and women. "SxS-related" projects had a similar composition, even though they involved a slightly lower number of women.[18]

Figure 15 - Average gender composition of teams



Source: Authors' elaboration on information in the DoWs

Teams of "other" projects involved fewer women (26% under FP6 and 30% under FP7). The difference is statistically significant for both FP6 and FP7 (at 1% level).

The gender composition of teams varies considerably by dimension. "gender and science" projects have the highest share of women (around 80% under SaS and 77% under SiS). A more balanced share between men and women can be seen in the "s

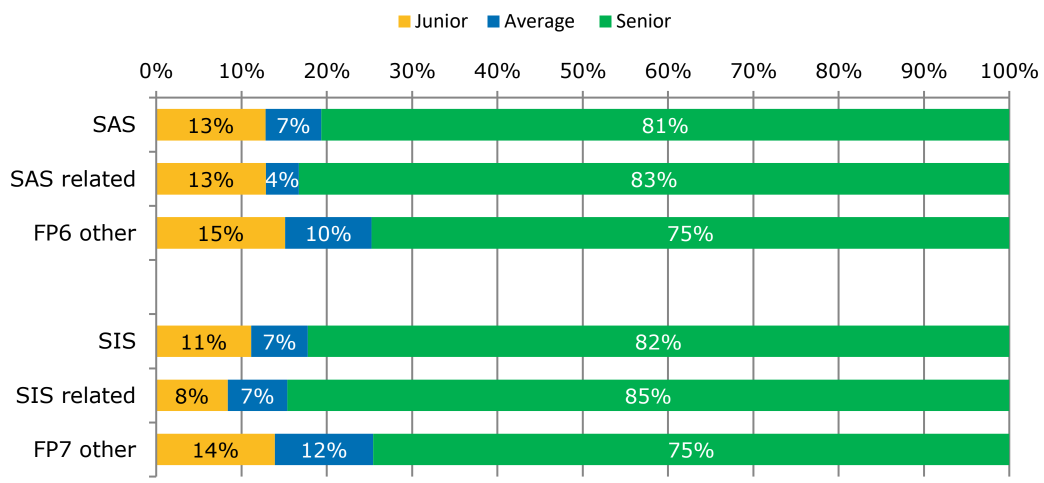
[18] This difference is statistically significant only for the "SiS related" projects (at 5% level) while it is not for the "SaS related" projects.

science literacy" and "civil society participation" dimensions (in both SxS and "SxS related" projects), while men prevail in "science and ethics", "governance and scientific advice" and "open access" (representing on average two/thirds of the projects team members). Nonetheless, the number of women nearly doubled in "governance and scientific advice" projects from SaS to SiS.

3.1.3.3 Seniority of the project team members

The seniority of team members was assessed by combining the number of years of professional experience and the level of responsibility in the project/organisation (using a keyword approach). By applying this approach to the analysis of project DoWs, the research team has calculated the share of project team members by seniority (Senior, Average, Junior) as illustrated in the following.

Figure 16 - Average team composition by seniority



Source: Authors' elaboration on information in the DoWs

As shown in the figure above, **most teams were composed of senior staff** (between 75% and 85% of the team members in the projects in scope). Seniority in SxS and "SxS-related" projects was usually higher than in "other" FP projects. However, these differences of seniority in teams are statistically significant only when comparing SiS with "other" FP7 projects (the t-test - comparing the two means of the samples - shows a value significant at 5% level).

It is worth noticing that the analysis of seniority is based only on the team members listed in the DoW, which do not necessarily include all junior team members working on projects.

A similar pattern can be observed in the analysis per dimension with no noticeable or statistically relevant differences: in all dimensions, most of the team members were senior.

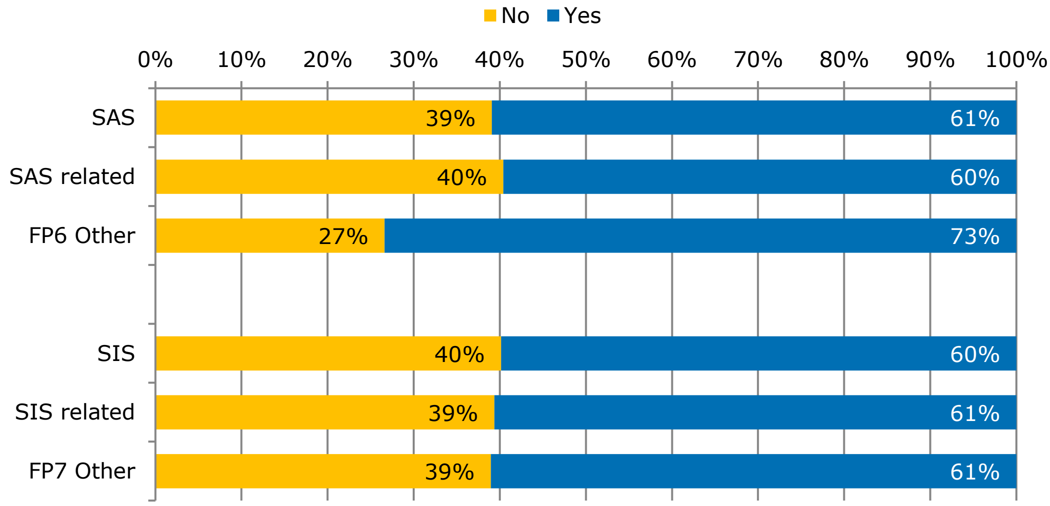
3.1.3.4 PhD holders among project team members

The share of PhD holders in SxS and "SxS-related" projects was particularly high - around 60% of the team members (see Figure 17).

The differences in the share of PhD holders between the SxS and their benchmark samples were not statistically significant. The only statistically significant difference is between the SaS projects and the sample of "other" FP6 projects. In this case, "other" FP6 projects had a higher share of PhD holders in the team (nearly +13%). This difference is no longer noticeable under FP7 where the share of PhD holders was similar in all samples.

Also for the analysis of PhD holders, the research team assumed that the high share of doctorates can be related to how the team is presented in the DoW. However, this variable can be considered a good proxy of the expertise involved in the projects.

Figure 17 - Average team composition by PhD holders



Source: Authors' elaboration on information in the DoWs

Looking at projects by dimension, it is worth noticing that there is a higher involvement of PhD holders in the "gender and science" (78% of the team members) and "Science and Ethics" projects (63% of the team members).

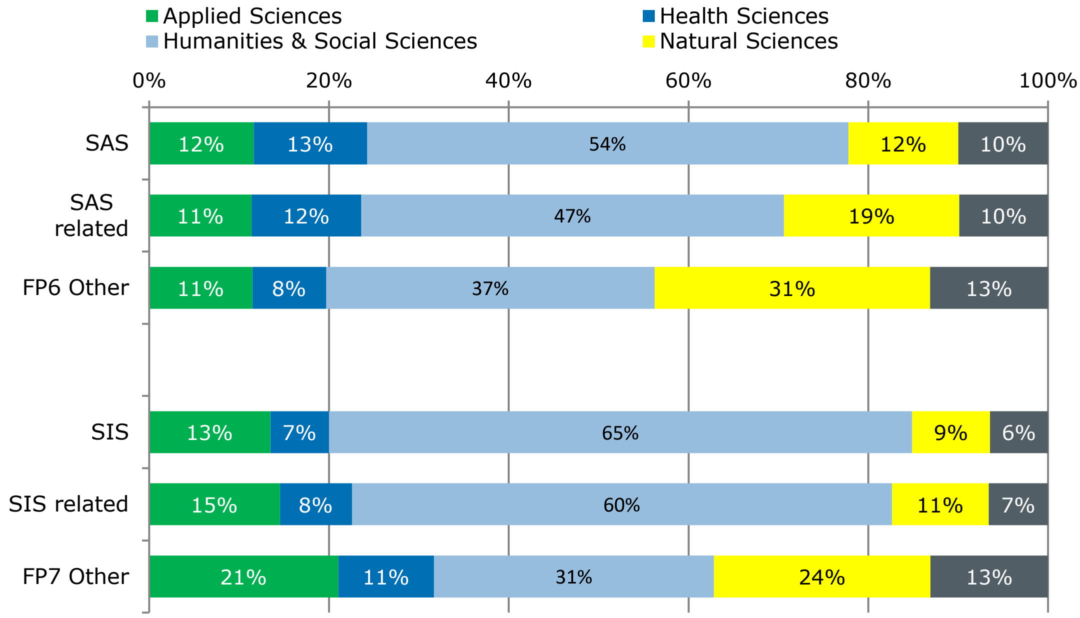
The differences between SaS and SiS are not statistically significant in any of the samples in scope. Similar trends can also be observed in the "SxS related" projects, with the exception of the "Science and Ethics" dimension, where the "SiS related" projects show a lower share of PhD holders.

3.1.3.5 Field of expertise of project team members

On average, the SxS project teams were composed of a high share of experts in the fields of humanities and social sciences. This share increased over the years: in SaS approximately half of project team members had this background, in SiS this share reached 65% (see Figure 18).

Other team members had a background in Applied, Health and Natural sciences in SaS projects (around 12% per category). This distribution slightly changed in SiS projects where the share of applied sciences experts increased to a small extent.

Figure 18 - Average team composition by field of expertise



Source: Authors' elaboration on information in the DoWs

Similarly, also in "SxS-related" projects, the majority of team members were experts in the humanities and social sciences. An analysis of the statistical significance on the share of experts in human and social sciences demonstrates that the differences between SaS/SiS projects and the sample of "SxS related" projects are not significant, while the differences with the samples of other FP projects are significant for SiS (at 1% level) and for SaS (at 5% level).

Overall, teams of "other" FP projects were usually composed of a larger number of experts in applied sciences (especially in FP7) and natural sciences (in FP6). The fields of expertise of team members vary according to the thematic dimension of analysis.

To conclude, the analysis of the team composition shows that SxS projects were, on average, quite different from the projects implemented in other parts of the FPs. In particular, SxS teams were composed of a higher share of experts in Humanities and Social sciences and had a stronger gender balance.

3.2 Output analysis

3.2.1 Potential impact

Potential impact indicators captured project characteristics that might contribute to supporting project actual impacts.

3.2.1.1 Network centrality

The analysis was performed on two networks, one for FP6 and one for FP7, that were created using information provided by eCorda on the following subsets of projects relating to cooperation activities:[19]

[19] Consistently with the "*Interim evaluation & assessment of future options for Science in Society Actions* (2012)" by Technopolis Group. Retrieved from: https://ec.europa.eu/research/swafs/pdf/pub_archive/phase02-122012_en.pdf

- 4,933 projects belonging to Block 1 and 2 of "Integrating and Strengthening the ERA" and "Euratom" within FP6;
- 7,834 projects belonging to "Cooperation" within FP7.

The list of participants of each project was used to build networks[20] showing how organisations (nodes) participated in selected projects (links). The table below reports some basic features of the two networks.

Table 5 - Features of the identified networks

Feature	FP6: Integrating and Strengthening the ERA (Block 1 and 2) and Euratom	FP7: Cooperation
Number of projects	4,933	7,834
Number of organisations	19,977	21,534
Number of links	451,230	491,752
Average number of partners (standard deviation)	45.17 (121.85)	45.67 (130.58)
Density (x 1.000)	2.26	2.12
Size of giant component[21] (%)	19,815 (99.19)	21,458 (99.65)

Source: Authors' elaboration based on eCorda data

The two networks have similar characteristics.

As the FP7 network is larger than the FP6 network (the number of organisations participating in FP7 is around 8% higher than in FP6) while the average number of partners is almost the same for the two networks,[22] the **density of the network**, i.e. the ratio between the actual link and the potential link, is lower for FP7. Finally, for both networks, the great majority of participants are in the giant component, implying that they are all connected, directly or indirectly, to each other.

For the two networks, the research team calculated a measure of global centrality, the network betweenness,[23] assuming that an organisation with high betweenness centrality has a large influence on knowledge diffusion throughout the network. The research team then assigned to each project the highest betweenness centrality of the participating organisation.

[20] The information reported in eCorda includes, amongst other, the list of participants (first type of node) and the list of projects (second type of node), with information (link) reporting to which project each participant has participated. A common simplification in literature is to transform this two-mode network in a one-mode network, where there is only one node and one link between participants. This implies a loss of information (i.e. the identity of the project), though allowing for a simpler analysis of the collaboration between organisations. This transformation requires an assumption on how a project is organised (Breschi and Cusmano, 2004) which distinguishes between two polar cases. The "star" case, where every participant is linked to the coordinator only, and the "clique" case, where each participant is linked with each other. Following literature, the research team assumes that a project implies full collaboration (i.e. clique assumption). For more details, see Maggioni and Uberti (2014) who have explored the different assumptions about the degree of hierarchy and symmetry implicit in each configuration.

[21] A network "component" is a group of nodes (e.g. participating organisations) that are all connected to each other, directly or indirectly. A "giant component" is such that almost every node is reachable from almost every other.

[22] The difference between the two distributions results not to be significant according to the Wilcoxon–Mann–Whitney test. This test is a non-parametric test of the null-hypothesis that two samples come from the same population. It can be applied also to unknown distributions, differently from the t-test that requires that variables follow a normal distribution.

[23] The betweenness centrality is calculated over the giant component of the networks. For the other organisations (nodes) not belonging to the giant component, betweenness is assumed to be equal to zero. The network betweenness centrality of an organisation (node) is equal to the number of shortest paths linking other organisations that pass through that node of the network.

SaS/FP6: 143 projects out of 165 SaS projects involved at least one organisation belonging to the giant component of FP6 "Integrating and Strengthening the ERA network'. 106 projects (i.e. 64.2% of the total) were able to attract organisations that are in the top 1% of the betweenness centrality ranking of the overall FP6 network. This percentage is higher for both the FP6 "SaS-related'" projects (51 out of 60, i.e. 85%) and for FP6 "other" projects. As a result, the betweenness centrality of SaS projects is significantly lower than the betweenness centrality of the other two samples;[24] while the two benchmark samples were not significantly different (see Table 6).

Table 6 - Betweenness centrality of SaS, SaS-related and other FP6 project networks

Sample	Mean (standard deviation)
SaS	0.0087 (0.01368)
FP6 related to SaS	0.014174 (0.1862)
FP6 other	0.02037 (0.02502)

Source: Authors' elaboration

When looking at the average centrality of SaS projects by dimension, results are different (see Table 7), with projects related to "Governance and Scientific Advice" and "Science and Ethics" showing a higher centrality.

Table 7 - Betweenness centrality of SaS projects, by dimension

Dimension	Number of projects	Mean (standard deviation)
Civil Society and Citizen Participation	20	0.0067721 (0.0077736)
Gender and Science	34	0.0070292 (0.0080850)
Governance and Scientific Advice	10	0.0138018 (0.0164102)
Open Access	3	0.0036701 (0.0056716)
Science and Ethics	36	0.0107006 (0.0168045)
Science Literacy	59	0.0086738 (0.0157074)

Source: Authors' elaboration

SiS/FP7: 169 projects out of 184 SiS projects involved at least one organisation belonging to the giant component of the FP7-Cooperation network. 147 projects (i.e. 79.9% of the total) were able to attract organisations that are in the top 1% of the betweenness centrality ranking of the overall FP7 network. This percentage, as in the case of FP6, is higher for both FP7 "SiS related" projects (53 out of 60, i.e. 88.3%) and for FP7 "other" projects (58 out of 60, i.e. 96.6%). In the case of FP7, though, SiS projects were not significantly different from the "SiS-related" projects, although they were significantly different from the "other" FP7 projects (Table 8).[25] Overall, SiS and "SiS-related" projects attract less central organisations than "other" FP7 projects, suggesting therefore that they are less attractive independently from the FP7 thematic programmes (i.e. SiS or other FP7 specific programmes).

Table 8 - Betweenness centrality of SiS, SiS-related and other FP7 project networks

Sample	Mean (standard deviation)
SiS	0.0150501 (0.0249724)
FP7 related to SiS	0.0166943 (0.0260188)
FP7 other	0.0223787 (0.0260188)

Source: Authors' elaboration

[24] The research team tested the difference in terms of betweenness centrality of these samples using the Wilcoxon–Mann–Whitney test, due to the degree of distribution asymmetry (i.e. skewness of the distribution).

[25] Again, the research team tested the difference in terms of betweenness centrality of these sample distributions using the Wilcoxon–Mann–Whitney test.

Again, as in FP6, the results on the average centrality of SiS projects by dimension are quite different. There are some interesting characteristics of SiS projects that should be noted: while in FP6 "Governance and Scientific Advice" and "Science and Ethics" show a higher centrality, in FP7, projects related to other dimensions also increase their centrality, namely those related to "gender and science" and "open access".

Table 9 - Betweenness centrality of SiS projects, by dimension

Dimension	Number of projects	Mean (standard deviation)
Civil Society and Citizen Participation	35	0.0102213 (0.0087873)
Gender and Science	23	0.0194914 (0.0304282)
Governance and Scientific Advice	34	0.0184566 (0.0311515)
Open Access	13	0.0184566 (0.0291728)
Science and Ethics	23	0.0234272 (0.0364825)
Science Literacy	56	0.0093478 (0.0159811)

Source: Authors' elaboration

In conclusion, the results presented show that:

- The difference of centrality between SaS/SiS projects and "SxS related" projects disappeared from FP6 to FP7;
- Both SiS and "SiS related" projects are less attractive than "other" FP7 projects;
- The centrality of SiS projects increased when assessed against SaS projects.

3.2.1.2 Scientific attractiveness

The research team considered external rankings of organisations as a proxy for centrality in corresponding networks and checked if FP6 and FP7 projects were able to attract the most important organisations. The team referred to the University ranking provided by the Centre for Science and Technology Studies (CWTS) of the Leiden University. The Leiden Ranking orders universities based on the excellence of research – defined in terms of number of top publications or international collaborations. The analysis referred to the ranking of scientific impacts in relative terms (i.e. ranking size-independent): the research team took into account the ranking for the period from 2006 to 2009 for FP6, and the ranking for the period from 2010 to 2013 for FP7. Each project was assigned the highest ranking of the universities participating in the project.

Table 10 shows the number of universities that the project samples were able to attract from the different clusters of ranking while Table 11 distinguishes these figures by dimension.

Table 10 - Participating top universities

Sample	Top 10 (%)	Between 11 and 100 (%)	Between 101 and 250 (%)	Total Top 250 (%)
SaS	0	30 (18.18)	29 (17.58)	59 (35.76)
FP6 related to SaS	2 (3.33)	23 (38.33)	7 (11.67)	32 (53.33)
FP6 other	1 (1.67)	18 (30)	12 (20)	31 (51.67)
SiS	5 (2.72)	40 (21.74)	47 (25.54)	92 (50)
FP7 related to SiS	0	13 (21.67)	21 (35)	34 (56.67)
FP7 other	0	16 (26.67)	17 (28.33)	33 (55)

Source: Authors' elaboration

Table 11 - Participating top universities in the different dimensions[26]

Dimension	Number of projects	Top 10	Between 11 and 100	Between 101 and 250	Total Top 250 (%)
SaS					
Civil Society and Citizen Participation	20	0	3	2	5 (25)
Gender and Science	34	0	4	6	10 (29.41)
Governance and Scientific Advice	10	0	2	1	3
Open Access, Open Science	3	0	0	0	0
Science and Ethics	36	0	10	10	20 (55.56)
Science Literacy	59	0	10	9	19 (32.2)
SiS					
Civil Society and Citizen Participation	35	0	5	9	14 (25.71)
Gender and Science	23	0	5	4	9 (17.39)
Governance and Scientific Advice	34	0	6	12	18 (35.29)
Open Access, Open Science	13	0	2	4	6
Science and Ethics	23	0	5	8	13 (34.78)
Science Literacy	56	5	17	10	32 (17.86)

Source: Authors' elaboration

Looking at *Social sciences and humanities*, which in principle should be more related to SxS themes, the SiS projects perform relatively better than the other two benchmark samples, while this is not the case for FP6, where there is no difference between scientific fields (Table 12).

Table 12 - Participating top universities, FP7, by ranking in Social sciences and humanities

Sample	Top 10 (%)	Between 11 and 100 (%)	Between 101 and 250 (%)	Total Top 250 (%)
SiS	0	29 (15.76)	57 (30.98)	86 (46.74)
FP7 related to SiS	0	16 (26.67)	13 (21.67)	29 (48.34)
FP7 other	0	8 (13.33)	16 (26.67)	24 (40)

Source: Authors' elaboration

In conclusion, the gap in attractiveness of SaS was filled in FP7, where SiS projects resulted to be as attractive as any other FP7 projects.

3.2.1.3 Business attractiveness

The research team adopted the same approach to assess the project capacity to attract companies. The analysis was focused on European firms that were most engaged in research and development (R&D) taken from the EU Industrial R&D Investment Scoreboard Ranking.[27]

More specifically, the analysis took into account the ranking of R&D investors in all European sectors in 2005 for FP6 and in 2012 for FP7. Each project was assigned the

[26] Percentages are reported only if the dimension is at least equal to 20.
[27] Which reports top EU corporate R&D investors by year. Please see: http://iri.jrc.ec.europa.eu/scoreboard.html

highest ranking of firms participating in that project. Table 13 reports the number of top firms involved in the selected FP6 and FP7 project samples.

Table 13 - Participating top firms, FP6 and FP7

Sample	Top 100	Between 101 and 500	Between 501 and 1000	Total Top 1000 (%)
SaS	1	0	0	1 (0.6)
FP6 related to SaS	0	0	1	1 (1.67)
FP6 other	5	1	1	7 (11.66)
SiS	1	1	0	2 (1.08)
FP7 related to SiS	0	0	0	0
FP7 other	5	4	0	9 (15)

Source: Authors' elaboration

The results show that SxS themes attract fewer top R&D firms than "other" FP projects. This is true for both SxS and "SxS-related" projects compared to "other" projects. The top firm involved in SaS is EDT –Electrice de France (FR)[28] while the two participating top firms in SiS are Nokia (FI) and Pearson Education Limited (UK), were both involved in Science and Literacy projects, in ECB (*European Coordinating Body in Maths, Science and Technology Education)* and ASSIST-ME *(Assess Inquiry in Science, Technology and Mathematics Education), respectively*.

It should be noted that these results do not consider the indirect participation of firms, for example through their foundations.[29]

3.2.1.4 Participation of CSOs

On average, SxS projects are able to attract more CSOs than their benchmark samples in both FP6 and FP7. Therefore, SxS projects are expected to have a higher impact on the political debate than other types of projects (see also section 3.1.2).

3.2.2 The Actual impact

3.2.2.1 Scientific impact

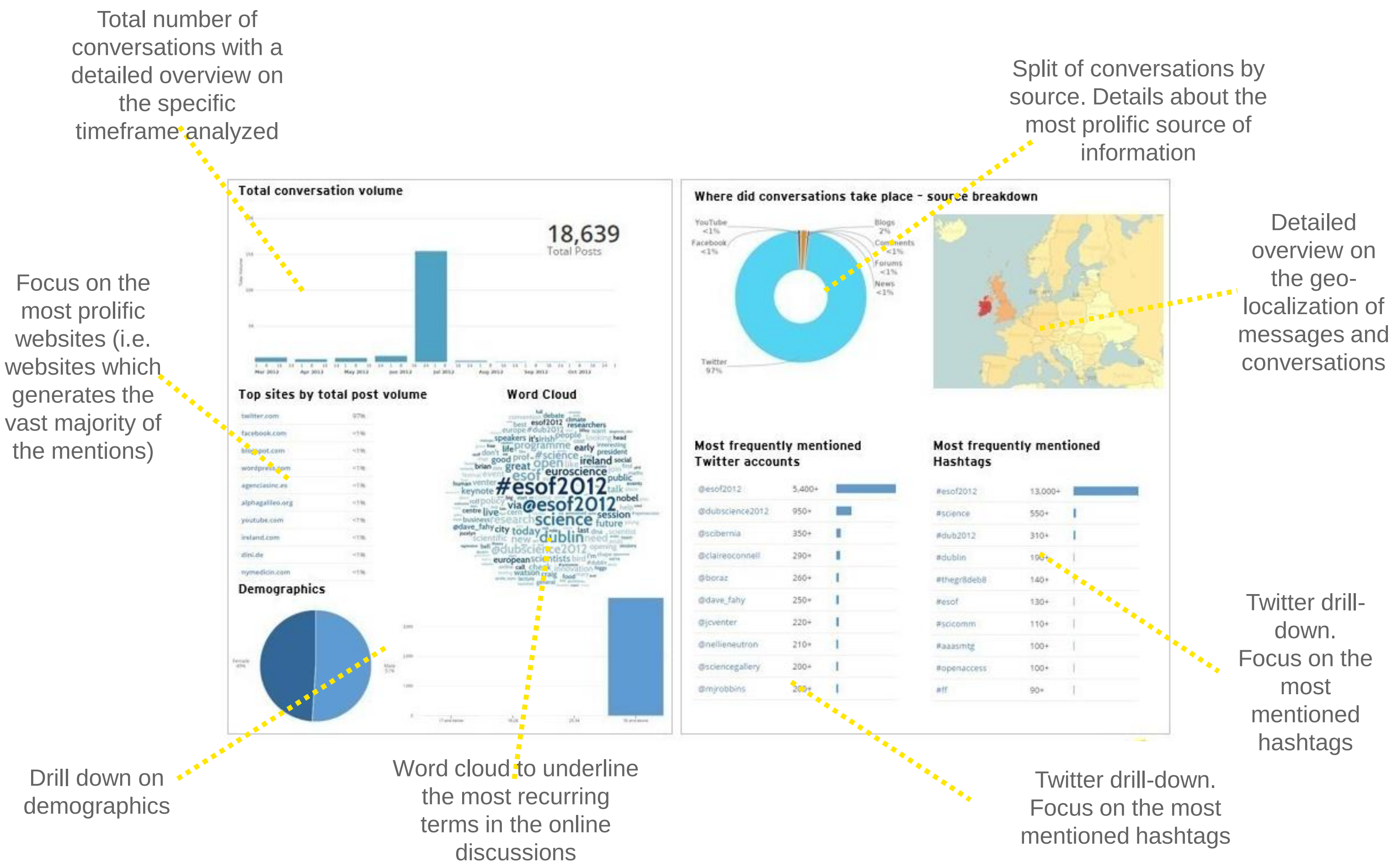
The research team collected all available publications relating to the projects. The analysis found that the scientific impact, defined as the number of scientific outputs generated by a project, was greater for "SxS-related" projects than for SxS projects. The case studies, the interviews with project coordinators, and the surveys fed into the analysis by providing further information on specific project scientific outputs.

3.2.2.2 Social-Media impact

The research team assessed the social impact of projects based on the number of project-related posts published on the main Social Networks (e.g. Facebook, Twitter, Instagram, Google+). Figure 19 provides a snapshot of the analysis performed.

[28] In the project STARC - STakeholders in Risk Communications.
[29] Relevant private companies such as Robert Bosch (ranked 8th in the EU Industrial R&D Investment Scoreboard) participated in SaS project FORM-IT "Take part in research", through its Foundation, i.e. Robert Bosch Stiftung.

Figure 19 - Example of the analysis performed for over 100 project posts



Source: Authors' elaboration

4 EVALUATION RESULTS

This chapter presents the answers to the evaluation questions (highlighted in the text), as resulting from the triangulation of evidence provided in the previous sections, information gathered from stakeholders, and in-depth analysis of 120 case studies.

4.1 Evaluation at project level

4.1.1 Relevance of projects

Were FP6/FP7 project coordinators and/or participants aware of the SaS/SiS programme action lines and objectives? (If yes, what action lines and/or objectives can they identify spontaneously)
Were FP6/FP7 project coordinators and/or participants asked by the EC (at negotiation, during the life of the project) to link their activities to SaS/SiS programme action lines and objectives?

Despite the continuity of the SaS and SiS programme action lines and objectives, the study found that only a relatively small number of SaS and SiS project coordinators and/or participants demonstrated full awareness of the overall objectives of the action lines. However, the awareness of programme objectives is more evident at topic or call level especially in SiS projects, where most project coordinators and participants made an effort to explain how their projects were contributing to the strategy of the Commission in the project proposal.

To understand whether the project coordinators and participants were aware of the action lines during the preparation of the proposal, field and desk research was undertaken. The survey asked stakeholders to indicate which of the SxS actions they have linked their project activities to. Most respondents selected the correct action line together with others (74%). Only 6.5% of project coordinators/participants identified (as single response) the correct action line their project was actually linked to. The action kines that respondents could identify spontaneously mainly related to SiS, in particular:

- Improving potential and broadening horizons with respect to issues of gender and science education;
- A more dynamic governance of the relationship between science and society.

The analysis of the DoW of all the SaS and SiS projects provided a similar result: amongst the analysed documents, only 5.7% made an explicit reference to the action line relating to the project call.[30] Moreover, 23% of the projects mentioned the related activity line and its objectives, whilst 67% of the DoWs contained an explicit referral to the call topic.

The most likely opportunity for project coordinators and participants to build their awareness around the strategy of the Commission on the SxS programmes is in the preparation of the DoW, where project coordinators and participants present their project and its activities. The structure of the DoW template may

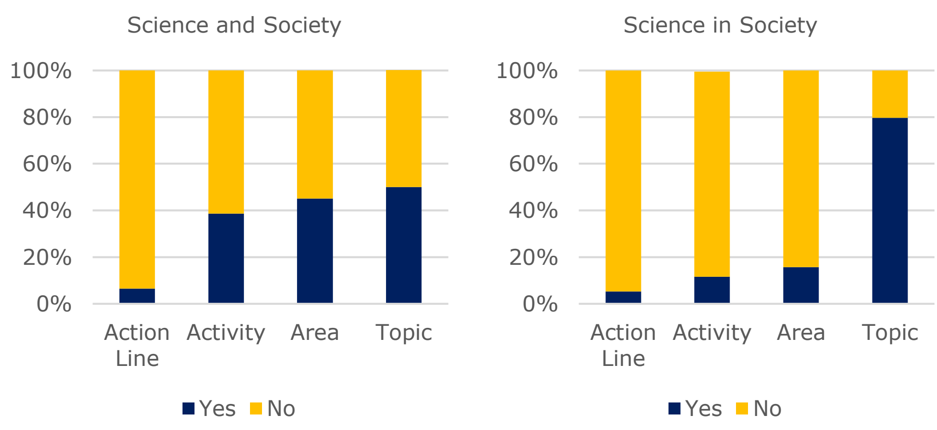
[30] The research team has assumed that the awareness of the programme objectives by project coordinators is higher when the DoWs clearly define the specific project topic/area/activity line or when these can be easily identified based on the information provided in the DoW text.

support the reflections of project coordinators on the alignment of the project activities with the programme action lines.

Analysis of the DoWs shows that a discussion on the alignment of the project activities with the objectives of the programme is more frequent for the DoWs of SaS projects than for those of SiS projects. More specifically, as shown in Figure 20, while a relevant number of the SaS project descriptions discuss the coherence of project objectives with programme action lines, activity lines and thematic areas, the SiS project descriptions usually limit the argumentation to the alignment at call topic level.

As shown in Figure 20, references to Action lines are few in both programmes, but SaS proposals used to mention, with a similar frequency, the Activity lines, the Thematic Areas and the Call topic. However, nearly half of the analysed proposals did not make any link to any of the objectives of the programme. On the contrary, 80% of the SiS proposals made an explicit reference to the Call topic. However, in most cases they did not mention any other higher objectives set by action or activity lines.

Figure 20 - Explicit references to SaS/SiS Work Programmes in project DoWs



Source: Authors' elaboration based on project DoW reports

Such discrepancy is due to the structure of the different DoW templates. Under the SaS programme, the project coordinators and participants were requested to discuss the "Relevance to the objectives of the Science and Society Programme". Most of the project coordinators took the opportunity to describe the relevance of the project to the WPs. The template for the SiS programmes did not include any similar specific questions, but asked project participants to discuss the "Concept and project objective" and, in another section, the consistency of the project expected impacts with those drafted in the WP, which are more explicit and detailed at call topic level.

From a more general perspective, the analysis of stakeholder perceptions, collected through the interviews and the final workshop, identified the engagement of civil society within the consortia as a key factor for ensuring the alignment of projects with the general objectives of the programmes. Indeed, when civil society is involved in the identification of potential challenges and the design of the research, this may support the implementation of research projects based on the real-life needs of society and, through the identification of challenges at an earlier stage, the development of more effective policy solutions.

The most frequent reason why project coordinators and participants made an explicit reference, in their project proposals, to the programme objectives was to "show the consistency of project objectives with the programme" (42%). This suggests that the trigger for the links was mostly a spontaneous creation by the project coordinators rather than the result of a top-down process. Several respondents also indicated that this was done "to increase the probability of success of the proposal" (26%) and because it was "requested by the call for proposals" (25%).

Amongst the coordinators of the sample of "SaS-related" projects, a significant share (37% on average) of the respondents considered their projects as having contributed to the SaS/SiS programme objectives. None reported that a direct link to the SxS Activities was requested/suggested by the Commission. However, analysis of the project proposals of the FPs "SxS related" projects shows that in some cases (around 10% of our sample) there is a clear reference to the SxS programme activities or to some projects.

In general, no difficulties were encountered in making such a link, although, in the words of an SiS project coordinator "objectives were rather vague and could include a wide variety of solutions".

Did project coordinators and/or participants aim to substantially link their activities to SaS/SiS programme action lines and objectives or to other relevant EC policy objectives (i.e. SaS Action Plan, ERA, Innovation Union, etc.)?

Although usually not explicit, there was a substantial link between project activities and the SaS/SiS programme action lines, objectives and other relevant EC policy objectives. In addition, survey results showed that a large number of project coordinators and participants intentionally aimed to link their project activities with the SaS and SiS programme objectives - especially at topic level - to highlight the relevance of their projects to the Commission's strategy in the science/society domain.

The perception of project coordinators and participants was that their projects mainly contributed to the SaS Action Line "Stepping up the dialogue on science and society, dealing with public understanding of science, young people's interest in scientific careers, and women and science" and the SiS Action Line "A more dynamic governance of the science and society relationship". Analysis of the distribution of funding and number of projects by action line shows that these are actually also the actions with the highest number of funded projects and overall EC contribution, confirming the alignment between the perception of stakeholders on EC strategic priorities in the science/society domain and the actual expenditure of the programmes.

Although the explicit link to the programme objectives is not evident in all the projects, the content and objectives of the funded projects is fully consistent with the objectives of the programmes. In particular, some patterns could be identified for each dimension in the case studies, as detailed below.

Gender and science. The most frequent objectives of the analysed SaS projects under the SaS Activity Line "4.3.5 Women and Science" and under the SiS Activity Line "5.2.1 Gender and Research" are: to (i) establish networks of female scientists (i.e. BASNET, WOMEN-CORE, PLATWOMSCI); (ii) pursue the empowerment of women and support the careers of female researchers (i.e. GENDERTIME, INTEGER); and (iii) perform studies to better understand the gender issues in scientific research (i.e. TRANSGEN, GENDERA). These objectives are fully in line with the objectives of the WPs to (i) boost gender equality in research and (i) foster the integration of the gender dimension throughout European research (although the latter seems less prominent in both SaS and SiS projects).

Science literacy. It is possible to identify two thematic areas under the SaS programme and four thematic areas under the SiS programme aiming at (i) improving science education – both formal and informal – and (ii) improving scientific communication to large audiences therefore promoting science and a scientific culture. The analysed funded projects have proven full consistency with these objectives and can be clustered into three groups: (i) projects that aim to improve science teaching in schools and improve young people's interest in scientific careers (i.e. WONDERS, PENCIL, ENGINEER); (ii) projects to improve public scientific awareness (i.e. DOE, SWEETS, ACCENT); and finally, specific projects to improve scientific communication to larger audiences (i.e. AVSA, ESCONET).

Science and ethics. The programme pursued two core objectives: (i) to deepen understanding of ethical issues due to scientific research and, (ii) improve the dialogue and information exchange amongst groups concerned with ethical issues. Most of the funded projects aimed at creating a (i) debate the ethical implications of science and technological innovation (i.e. FORUM BIOETHICS, BIONET, NEBRA), or on conducting research on ethical concerns (i.e. VALUE ISOBARS, SYNTH-ETHICS, EDIG).

*Governance and scientific advice, RRI***.** The creation of a stronger link between science and policy making, including the integration of societal needs is one of the core objectives of the SaS/SiS programmes. This concept is developed in several forms, mostly by implementing projects that (i) ensure science-based policy making (i.e. MIDIR, ROBOLAW), others by (ii) improving the link between representatives from the civil society and policy makers (i.e. NERRI, ASSET, MAPPING), while (iii) organising public events on science related issues with a large outreach (i.e. ESOF, CONFERENCE SACRIMM).

Civil society and citizen participation. Both the SaS and the SiS programmes included specific activities that aimed to (i) encourage the participation of CSOs in the research process and (ii) support the interrelation between policy making and civil society. These objectives were translated by the funded projects into three groups of activities: (i) activities aiming to support the participation of CSOs in research projects (i.e. SAFMAMS, WINDFARMPERCEPTION); (ii) activities aiming to establish a link between representatives of civil society and policy makers on issues relating to scientific research (i.e. CAPOIRA, GAP1; FAAN); and (iii) the organisation of large-scale scientific events that engaged and attracted the general public (i.e. HULDA).

Open access, open science. An important innovation introduced by the SiS programme was the inclusion of a thematic area focused on fostering the debate on information dissemination, including access to scientific results and the future of scientific publications, taking into account measures to improve access by the public. In line with this objective, SiS projects like SERSCIDA and RESPONSIBILITY aimed to improve scientific knowledge exchange amongst institutions and increasing the openness of research.

In addition to examining whether the project coordinators or participants aimed to substantially link their activities to SxS programmes lines, the research team also examined the extent to which a connection existed between project activities and the SaS Action Plan. 42% of the survey respondents indicated their projects contributed - directly or indirectly - to the actions of the SaS

Action Plan, but the analysis of the SaS and SiS project proposals showed that only 14% of the projects explicitly mentioned the Plan and described how the project activities intended to contribute to its objectives (22% SaS projects and 8% of the SiS projects). However, a further analysis of the case studies indicated that all projects were fully relevant to the programme objectives and contribute to the actions of the Plan.

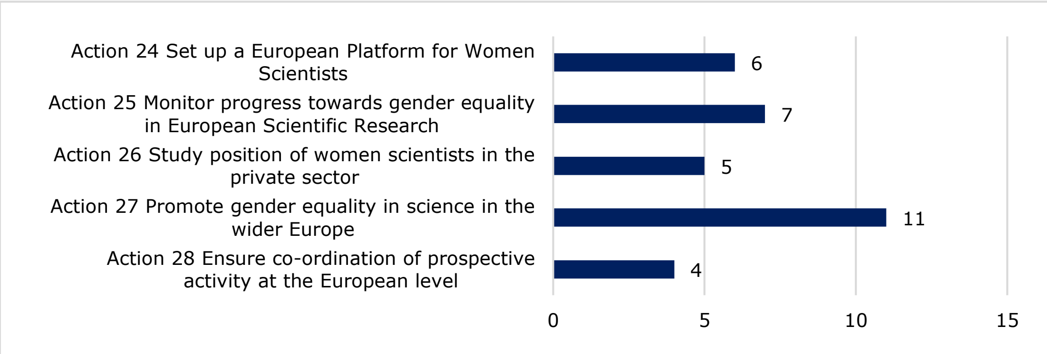
The SaS Action Plan was composed of 38 actions structured into three axes: (i) "Promoting scientific education and culture in Europe"; (ii) "A science policy closer to the citizens"; and (iii) "Responsible science at the heart of policy-making". The analysis carried out shows that the five most addressed actions were:

- Action 36: Establish guidelines on the use of expertise;
- Action 20: Organise local and regional dialogues on "Science and Society";
- Action 23: Inaugurate public discussions and hearings on specific themes;
- Action 27: Promote gender equality in science in the wider Europe; and
- Action 29: Help set up information and documentation observatory for ethical issues.

The following paragraphs provide an overview, per dimension, of the contribution of the case studies to the actions of the SaS Action Plan.

Gender and science. The figure below shows the actions covered by the projects falling under the "Gender and science" dimension.

Figure 21 - Actions of the SaS Action Plan covered by Gender and Science projects



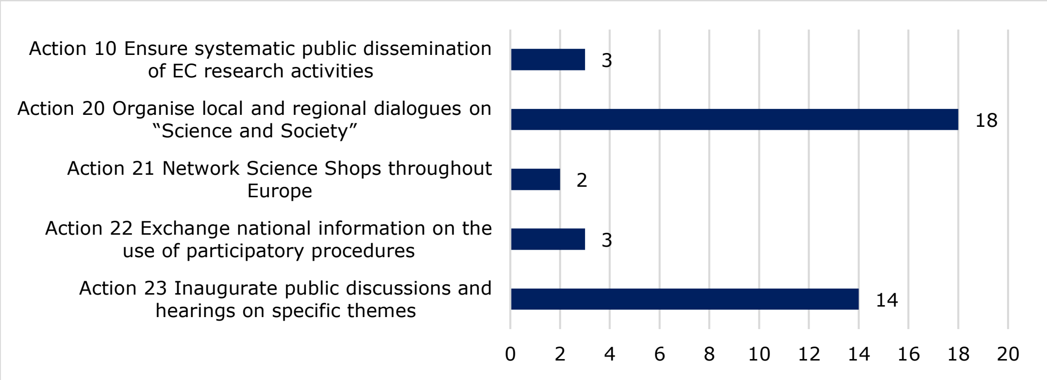
Source: Authors' elaboration based on the case studies

The analysis of 14 "gender and science" case studies shows that most projects aimed to cover two or more actions of the SaS Action Plan. The most covered actions were: (i) Action 27 "Promote gender equality in science in the wider Europe" covered by 11 case studies; (ii) Action 25 "Monitor progress towards gender equality in European Scientific Research" covered by seven case studies; and (iii) Action 24 "Set up a European Platform for Women Scientists" covered by six case studies.

Civil society participation. The involvement of civil society was primarily addressed by Actions 19 to 23 of the SaS Action Plan. Figure 22 shows the actions of the SaS Action Plan covered by the Civil Society Participation case studies. As illustrated below, Action 20 (Local and Regional Dialogues for

Science in Society) and Action 23 (Specific events for the European Research Area) were the prevalent actions.

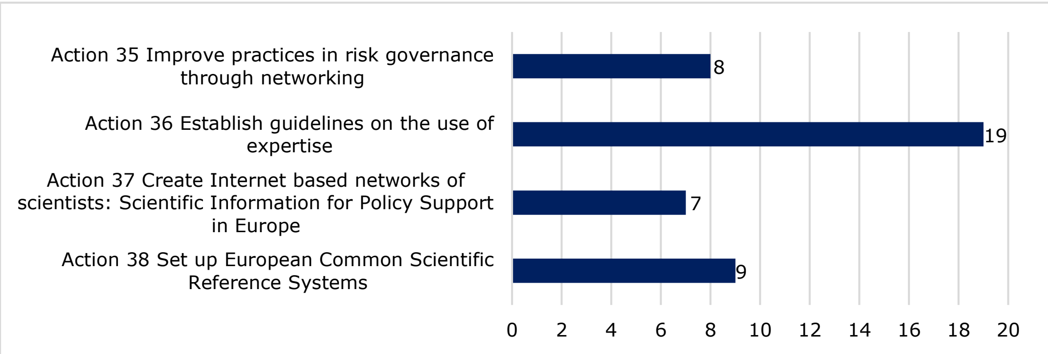
Figure 22 - Actions of the SaS Action Plan covered by Civil Society projects



Source: Authors' elaboration based on the case studies

Governance and scientific advice, RRI. Governance and scientific advice, RRI case studies contributed to various actions of the SaS Action Plan. The majority of projects contributed to Action 36 relating to the setting up of guidelines to ensure greater openness and accountability in the use of expertise in science-based policy development. Fewer projects contributed to the other relevant actions directly falling under governance (Action 38 "Set up European Common Scientific Reference Systems" and Action 35 "Improve practices in risk governance through networking").

Figure 23 - Actions of the SaS Action Plan covered by Governance and Scientific Advice projects

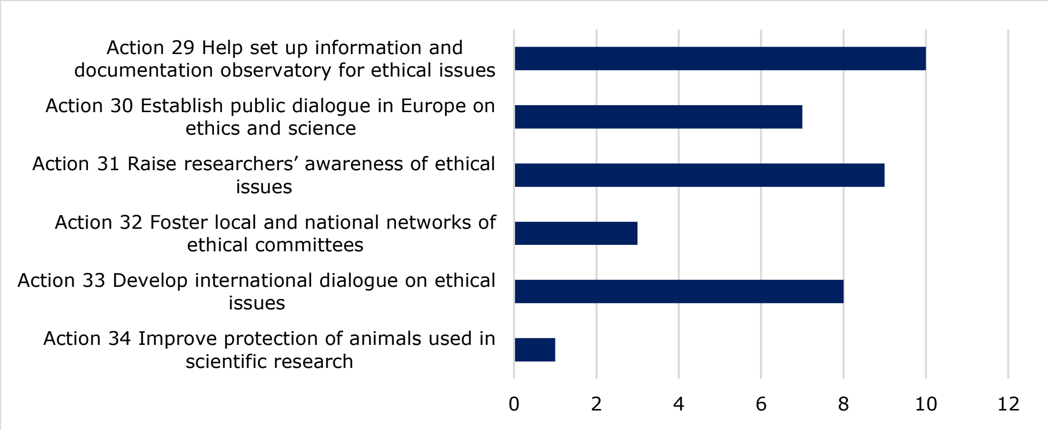


Source: Authors' elaboration based on the case studies

Open access. The open access case study activities were relevant to Action 10 relating to the systematic publication of public information on Community Research Activities.

Science and ethics. The SaS Action Plan focused on "responsible science at the heart of policy making", with actions 29-34 that addressed the ethical dimension in science and new technologies. Analysis of the case studies falling under this dimension shows that their activities covered these actions, and primarily Action 29 (Help set up an information and documentation observatory for ethical issues), Action 31 (Raise researchers' awareness of ethical issues), and Action 33 (Develop international dialogue on ethical issues).

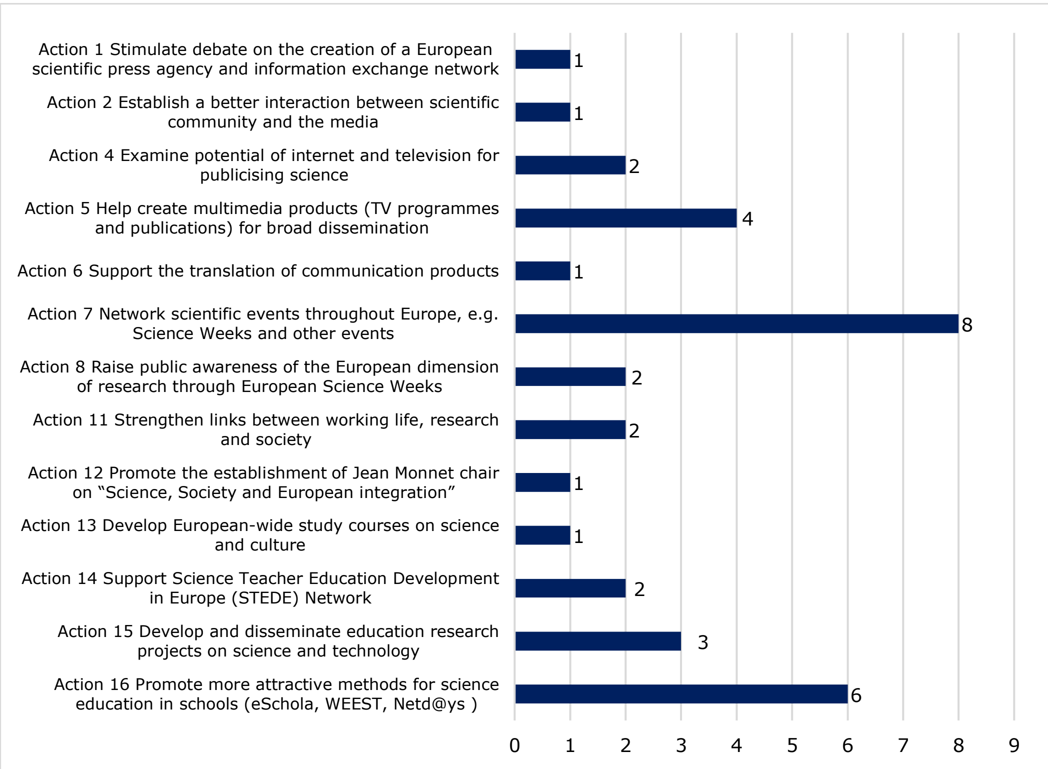
Figure 24 - Actions of the SaS Action Plan covered by Science and Ethics projects



Source: Authors' elaboration based on the case studies

Science literacy. There were no specific actions relating to science literacy in the SaS Action Plan. Analysis of the case studies shows that the activities covered a number of different actions. However, some actions related to the organisation of science weeks (Action 7), science education at school (Action 16), and dissemination of scientific information (Action 5), are more covered. All of them contributed to the priority of improving science literacy.

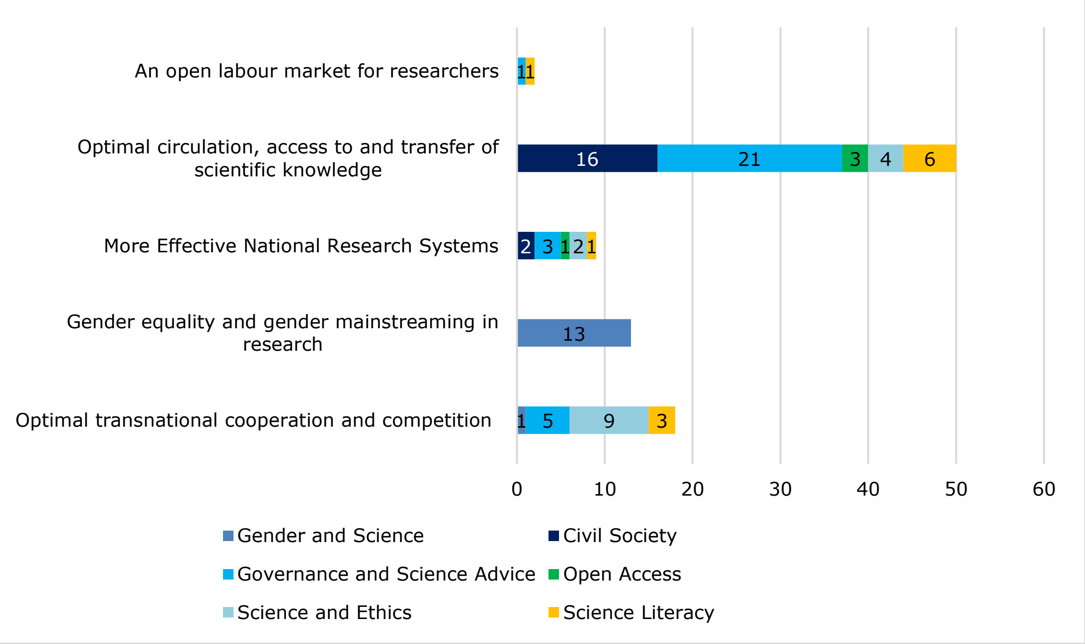
Figure 25 - Actions of SaS Action Plan covered by Science Literacy projects



Source: Authors' elaboration based on the case studies

As for the project relevance to the European Research Area and the Innovation Union, almost two thirds (63%) of survey respondents for both SaS and SiS projects claimed to have linked their project objectives to the ERA policy. However, analysis of the project DoWs shows that fewer than 30% of the projects made an explicit reference to the ERA when describing the objectives and the context of the projects. Nevertheless, analysis of the case studies shows that the project activities contributed to a number of ERA objectives (see Figure 26).

Figure 26 - Contribution of the projects to ERA priorities, by dimension



Source: Authors' elaboration based on the case studies

The "gender and science" projects were assessed as relevant to the ERA objective of ensuring *"gender equality and mainstreaming in research".* Project activities under the other five dimensions ("civil society", "governance and scientific advice", "open access", "science and ethics", and "science literacy") were assessed as being relevant to the two prominent ERA objectives relating to ensuring 'more effective national research systems' and 'optimal circulation, access to and transfer of scientific knowledge'.

A number of projects related to "governance and scientific advice", and "science and ethics" were assessed as being relevant to the ERA objective of ensuring *"optimal transnational cooperation and competition*". Indeed, projects under these dimensions tended to focus on effective cooperation to ensure good governance and respect of ethical science.

Finally, the research team examined the relevance of SxS projects to the objectives of the Innovation Union. In this case, 29% of the survey respondents claimed to have linked their project objectives to this policy. However, the analysis of DoWs shows that only a limited number of SiS projects made an explicit link to this policy.

As for the ERA, the activities reported for the case studies were assessed as being relevant to the objectives of the Innovation Union, and mainly to the objective "Strengthening the knowledge base and reducing fragmentation".

In conclusion, most projects, while not making explicit reference to the ERA and the Innovation Union, substantially addressed their objectives.[31]

4.1.2 Effectiveness of project implementation

Has the project achieved the specific objectives mentioned in the Description of Work? How well did the project meet other specific objectives of key SaS/SiS dimensions?

Overall, a large majority of the projects achieved the specific objectives outlined in their DoW.

Almost 90% of the SxS project participants and coordinators responding to the survey agreed on the overall effectiveness of projects. Specifically, 30% of the SxS project participants and coordinators reported having achieved more than half of the expected results, 41% claimed to have fully achieved all planned objectives, and 19% claimed to have performed beyond expectations. Just a small percentage of the respondents (9%) reported having achieved less than half of the objectives defined in the DoW.

The assessment of the case studies confirms the results of the survey. In order to assess whether the projects achieved their specific objectives, the analysis compared the objectives stated in the DoW with the deliverables of the projects or the results reported in the final reports. Overall, the effectiveness of projects was very high, as more than 82% of the case studies achieved the specific objectives stated in the DoW. Three case studies went beyond their expected objectives (DISCOVERY DAYS, WINDFARMPERCEPTION, and RISE) due to the implementation of additional activities (e.g. additional conferences and workshops) than those planned in the DoW.

However, some difficulties emerged in the assessment of the effectiveness of projects based on their final reports due to the attitude of project consortia to positively report achievements and insist on successes. This attitude was indeed already remarked in the findings of the Evaluation of future options for Science in Society Actions (Technopolis, 2012a).

The analysis of the case studies shows that some projects encountered important difficulties which directly affected the achievement of the results. In some cases (BASNET, ENCOUWOMSCI) the identified difficulties reduced the effectiveness of dissemination activities. In other cases (for instance TRANSGEN) difficulties encountered by the project team requested additional efforts to achieve the project expected results.

Other projects reported difficulties which did not affect the achievement of the project objectives, but which sometimes caused delays in project activities. In some cases, such delays resulted in requests for extensions of deadlines in order to meet the expected objectives (i.e. ESCW, PROFILES, PSX2 and STEPE).

Based on the case studies and the survey, the main difficulties encountered were:

- The **mis-management of time and/or resources**, which was the main reported difficulty. For example, FAAN, DISCOVERYDAYS, SED and PSX2 pointed to the short timeframe for some activities which often caused

[31] This might be explained by the fact that the ERA and the Innovation Union were not fully completed at the time of SxS projects implementation.

some delays in the implementation of the projects. The ADVANCE project aimed to develop strong relationships between mentors and mentees and the duration of the project was small to allow the development of this type of interaction. Other projects encountered financial difficulties such as STEPE or CAPOIRA. The lack of financial resources in the case of two organisations involved in the EST project, was also an issue in the implementation of the project.

- The low degree of engagement of targeted stakeholders or policy makers, as reported by the participants to the survey.
- The challenges in communicating with other consortium members led to difficulties in the management of large consortia with different geographical locations, in establishing a functional knowledge sharing mechanism or in the interaction with partners with different cultural and educational backgrounds.

Have project results and information been disseminated (actively/appropriately) as foreseen in the Description of Work?

The dissemination of project results progressively gained importance from FP6 to FP7 - and especially in H2020 - along with the acknowledgement of the need to make society aware of results in view of achieving positive impacts, as reported by the EU and national officials involved in the implementation of both FP6-SaS and FP7-SiS programmes during the interviews.

To assess whether the project results and information were disseminated as foreseen in the DoW, the research team performed an in-depth analysis of the case studies and compared the foreseen dissemination activities presented in the DoWs with those performed. Even if not all projects provided a sufficient amount of documentation (i.e. some missing DoWs, missing deliverables on dissemination plan or final reports), the analysis shows that around 83% of the projects fully implemented the expected dissemination activities. However, in most cases it is not possible to quantify the link between the planned outreach (i.e. the number of participants attending an event) and the actual number.

The dissemination activities were diverse, their development depended on the type and objectives of the projects, and they covered all the main types of tools and supports available. This confirms results of past evaluation studies. As outlined in the Technopolis 2012 Evaluation and assessment of future options for Science in Society Actions, a comparison of the results obtained for FP7 SiS and FP6 SaS projects revealed no significant differences, with a broadly similar panoply of dissemination approaches.

Several types of activity can be identified:

- The dissemination of the results through publications, conferences, workshops, radio and TV interviews, and articles in newspapers;
- The dissemination of information through brochures, leaflets, information conferences, press releases, articles in newspapers, items on Radio and TV, and social media;
- The promotion of events through networking, invitations to conferences and events, and press releases.

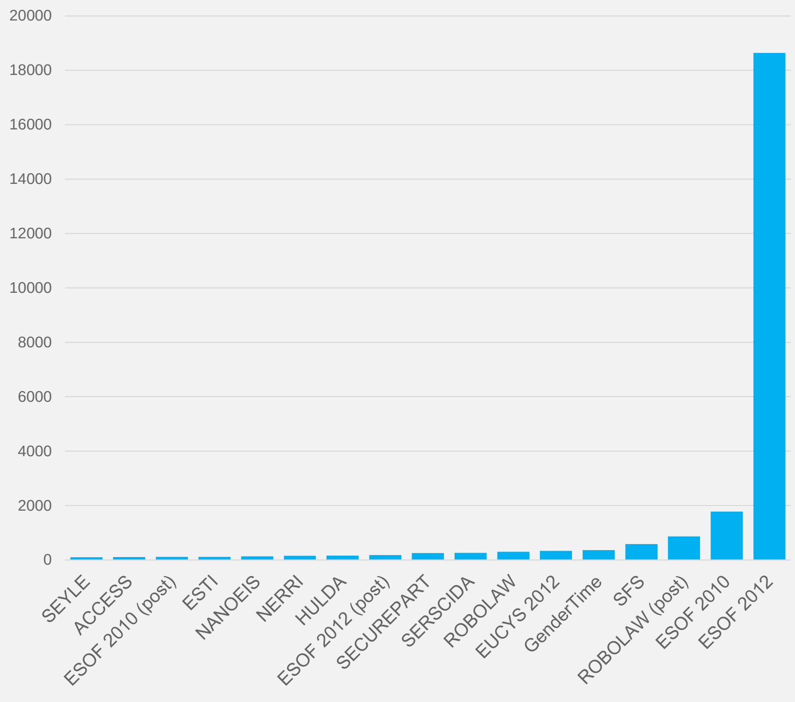
The types of activity developed in projects varied according to the type of project and the target audience. Interestingly, the mid-term assessment of the SaS programme (European Commission, 2007) found that many projects considered dissemination as a secondary activity, which was considered as a 'significant handicap for the overall impact of the programme'. The research team found that the level of importance given to dissemination is indeed associated with the objectives of the project. For instance, some projects were dedicated to the organisation of conferences or events, with the dissemination activities focused on the communication on the event and the recruitment of participants.

Box 1 - Social Media Analysis

The study found that social media was used to disseminate information only by FP7 projects. Indeed, the FP6 case studies underlined that at the time of the implementation of FP6 projects, technology was insufficiently developed and adopted to be used. The use of social media can, therefore, be seen as a positive impact for dissemination activities for FP7 projects, addressing some concerns which were identified in the mid-term Evaluation of the FP6 projects including a lack of diversity of dissemination channels and tools.

The social impact of projects was measured by the number of project-related posts published on major social networks (i.e. Facebook, Twitter, Instagram, Google+ etc.). The vast majority of the case studies scored a number of posts below 100 mentions (106 out of 120). Only 14 projects scored over 100 posts (see Figure 27). Online occurrences on digital and social channels were around a few hundred for the majority of examined projects, with the exception of some projects that achieved significant results, with thousands of occurrences. This is especially the case for the ESOF2012 project, which had the highest conversation volume, with over 18,000 posts, and a concentration of 15,000 posts occurred during July 2012 (during the conference). The importance of social media therefore seems to be related to the type of project, with conferences more likely to have a social media impact. Moreover, ESOF2012 was one of the few projects which planned its use of social media and allocated specific resources to this. Other projects such as SFS and NERRI announced the use of social media in their DoW and finally reported a certain impact.

Figure 27 - Number of posts per SxS projects



Source: Authors' elaboration

Twitter turned out to be the highest contributor to the volume of posts. An exception is made for the projects HULDA, SEYLE, ESTI and ACCESS, for which online blogs contributed the most. Concerning the projects without a high social media impact, some of them planned to use these activities (NANODIODE, MAPPING or RISE) but did not succeed in creating social media popularity around the projects.

Not surprisingly, networking is perceived as a key factor for the effectiveness of the dissemination activities. Networking between project partners, and with other international organisations or projects was underlined by many project participants as a crucial factor to disseminate project results and information about project events. Even at an operative level, some project participants underlined their integration and collaboration with existing networks to use their mailing lists or newsletters to communicate information about the project. Even if available data do not allow for meaningful comparison between the effectiveness of dissemination activities of the SaS and SiS programmes, the wider networks created by SiS projects compared to SaS - through larger size of consortia and an increased average number of team members - suggest an increased dissemination capacity moving from FP6 to FP7.

Has the project achieved the objectives as mentioned in the 'impact' description in the corresponding call topic text in the work programme?

An analysis was undertaken of both survey results and case study findings.

Almost all SxS project participants and coordinators considered that their projects contributed to the SaS and SiS WPs (95%). A large share estimated the degree of contribution to be high (39%) or very high (35%). Just a small share indicated a low or very low contribution: in these cases, the respondents questioned the achievements of the project or reported low achievement since the project was still on-going at the time of the survey.

The case studies also provided input to this question. The analysis looked at the comparison between the objectives and results of the projects with the objectives as mentioned in the 'impact' description in the corresponding call topic text in the WP. The objective of the exercise was to determine to what extent projects across different dimensions were effective in responding to the topic-level objectives and expected outcomes.[32]

The analysis shows that all the case studies were in line with the expected impacts of the call topic text.

Box 2 - Analysis of project impacts: matching with call topic texts

Gender and science. Overall, the selected *"women in science/gender and research"* projects were in line with the impacts foreseen in the related call topic text in the WP.

Concerning SaS, the expected impacts were not narrowly defined in the WPs. Some projects stimulated a broad policy debate at the national and regional level and encouraged the mobilisation of female scientists for their empowerment in science decision-making bodies and in policy definition/making. For instance, BASNET focused on female scientists in the Eastern & Central Europe and in the Baltic States. The project established an interregional Baltic States Network amongst female scientists and policy makers to influence the EU science gender policy and national agenda.

Other SaS projects developed a better understanding of the gender issue in scientific research by either broadening the knowledge base on women and science in specific

[32] It should be noted that only FP7 Work Programmes included an "expected impact" section for each topic. For FP6 Work Programmes, these were deduced from the analysis of the objectives set for each area.

sectors or looking at specific topics from a gender-neutral perspective. As for the former, WOMEN-CORE mapped European research institutions in construction research and assessed the state of play of women in construction research. In contrast, TRANSGEN focused on how to translate and advance the idea of gender mainstreaming in the transport sector. Finally, ELSA focused on the evaluation and measurement of scientific excellence in assessment and recruitment procedures as well as on gender differences in research financing and bibliometrics.

While progress was made by FP6 SaS projects in raising the participation of women in science and research, further action was needed to tackle gender imbalances in European Research. The SiS WPs therefore more clearly set out the expected impacts under each relevant research topic. Overall, projects funded through SiS calls were aligned with the expectations set in the WPs.

A first expected impact was the suppression of those factors limiting the participation of women in research, in specific disciplines and decision-making positions. To achieve such an impact, some SiS projects implemented activities to involve research bodies in the debate on gender and research. For instance, GENDERA created a database gathering 61 good practices in the promotion of gender balance in research and established nine national Task Forces involving top policy/decision makers and high-level representatives from higher education and R&D organisations in the national debate on gender equality in research for the development of action plans. It produced practical guidelines for research organisations to advance gender equality in research and recommendations to integrate the gender dimension into science policy throughout Europe.

The analysis of the case studies suggests that the efforts made in mainstreaming gender equality in research policy and programmes have contributed to supporting gender equality in institutional practices and culture. Notwithstanding the relevance of the achieved results, actual impacts on women’s participation in science and research will be observed in the long run.

Science literacy. With regards to FP6 SaS WPs, all projects were aligned with the expected impacts deduced from the objectives of the different areas. Many projects contributed to the SaS expected impact of an improved science and scientific culture in the wider public. The activities performed can be clustered by type to illustrate the main achievements:

- Science festivals and celebration initiatives;
- Mobile exhibitions;
- Media coverage.

Other SaS projects carried out activities to enhance young people’s interest in science, science education and scientific careers:

Within the SiS Work Programmes, the expected impacts were more clearly identifiable in the corresponding call topic text. Overall, SiS projects aligned with the expected impacts by carrying out a wide range of activities.

With regards to SiS expected impacts in science and society communication, some projects improved science communication products and methods. For instance, AVSA analysed the current supply of radio and TV science programmes broadcast in Europe, and gathered data on factors influencing the public perception of existing audio-visual science programmes. ESCONET organised a mass training activity in communication via workshops for high-level European scientists in different European languages reaching 160 trainees in 2009 and 124 trainees in 2010. Finally, ACCENT enhanced synergies and networking between science centres and museums engaged in communication on climate change through the arrangement of several events, seminars and workshops in national venues.

Science and Ethics. The objectives and results of the case studies were highly aligned with the expected impacts in the corresponding WPs. The FP6 case studies well reflected the priorities of the WPs on the activity level.

Concerning the objective of fostering dialogue, three projects can be mentioned. The BIONET project created a network within and between China and the European Union that aimed to map the rationale for, and practices of, ethical governance of advanced life science and biomedical research. The GENBENEFIT project brought together an interdisciplinary team of ethicists, lawyers, economists, medical doctors, specialists in gender studies, representatives from indigenous communities and policy advisors from five continents to study four paradigmatic international case studies on benefit sharing. The EDIG project aimed to generate new knowledge in the field of ethics and investigate ethical dilemmas in prenatal diagnostics.

The focus of ethics under FP7 shifted towards the wider issue of governance, specifically anticipating and better understanding ethical issues and developing ethical frameworks. Three projects reviewed under FP7 contributed to developing ethical frameworks for new technologies and emerging fields of science; two of them had transversal objectives in terms of thematic focus and one was focused on a specific domain. The STEPE project was focused on anticipating public concerns on new technologies. It provided strategic inputs to research on appropriate ethical frameworks for new technologies and research on the foresight of ethical issues likely to emerge in the context of the societal embedding of new technologies. On a more practical level, early investigation of emerging public ethical concerns was used to inform and update the 2008 Eurobarometer Survey on the Life Sciences and Sensitive Technologies, which is used extensively by policy makers. VALUE ISOBARS explored value-based and value-informed governance of the science/society relationship in Europe and resulted in the definition of an action plan. The SYNTH-ETHICS project made more targeted contributions to the domain of synthetic biology.

Governance and Scientific Advice, RRI. Topics covered by this thematic area developed extensively over the period within the scope of the evaluation, with an increasing commitment to actively governing science. Topics covered a wide range of objectives, including: establishing a more dynamic interface between science and policy making (FP6); risk governance (FP6) and integrative approaches to risk governance (FP7); greater use of scientific expertise in policy making (FP6); exploring and developing the relationships between science, democracy and law (FP7); as well as increased societal relevance of research (FP7). In total, eight projects from the Governance and Scientific Advice, RRI dimension were selected for the case studies, namely two projects under SaS and six projects under SiS (two ESOF case studies were awarded via an *ad hoc* call in 2007). The objectives and results of the sample of projects reviewed were broadly in line with the activity level objectives and expected impacts set out in the related Work Programmes.

Under FP6, the case studies were well aligned with the objectives of improving risk governance and establishing a more dynamic interface between science and policy making. In the area of risk governance, the MIDIR project aimed to develop a resilience and risk governance concept, based on existing approaches, and an accompanying risk management tool.

The FP7 case studies are also aligned with the objectives in the corresponding WPs and illustrate well the transition to a more holistic approach to governance (as exemplified by the emergence of the RRI concept). Specifically, they addressed the objectives of exploring and developing the relationship between science, democracy and law and the active participation of society (particularly via the Mobilisation and Mutual Learning Action Plan –MMLAP).

The MMLAP, introduced in 2012, was intended to create mechanisms for effectively tackling research and innovation related challenges through partnership and dialogue between different actors, allowing stakeholders to govern and shape research in emerging science, technology and innovation in response to the views and needs of society. The NERRI, ASSET and MAPPING projects put this innovative tool into practice in the fields of neuro-enhancement, global pandemics and crisis management and Internet and society.

Civil society and citizen participation. Topics under this dimension were varied. They aimed to increase the involvement of CSOs in research via, for example, co-operative research processes, increasing the societal relevance of research, and encouraging exchange and cooperation between local actors, such as science museums, science centres and/or the organisers of national and regional events. The specific objectives are embedded in other dimensions, such as "governance", which places an emphasis on the use of highly participatory approaches, and "science literacy", which aims to engage citizens to cultivate scientific culture and reduce the distance between science and the public at large.

The FP6 case studies were aligned with the objectives of encouraging the active participation of society at large in policy development and increasing societal participation in research. SAFMANS was focused on feeding the policy-making process, particularly in the area of fisheries management. WINDFARMPERCEPTION sought to facilitate scientific communication and societal demand-driven sharing of knowledge with local civil society concerning wind energy.

The FP7 case studies were well aligned with the intended impacts of stronger civil society involvement, specifically through the co-operative research approach, and cooperation between key intermediaries on the local, national and regional level. Two projects were particularly effective in contributing to the outcome of increased civil society involvement in research and innovation. The GAP1 and FAAN projects harnessed the cooperative research approach. GAP1 had a wider focus on cooperative research in general, producing a portfolio of 12 case studies on research proposals (including marine spatial planning, ecology, management measures, discarding, empowering industry to assess resource sustainability, and management decision making) and carrying out comparative analysis to identify common patterns and themes in the work. FAAN was focused on Alternative Agro-Food Networks (AAFNs), looking in particular at how current European, national and regional policies inform the development of AAFNs, and how policy frameworks could better facilitate them.

Open access, open science. An overview of the case studies shows that all the selected projects were in line with the expected impacts deduced from the WPs.

In the FP7 SiS programme, an expected impact for this dimension was an improved coordination of existing Member State and Associated Country initiatives on access to, and dissemination of, scientific information and new/innovative coordination initiatives. To achieve such an impact, projects fostered the debate on information dissemination and provided new measures for public access. For instance, RESPONSIBILITY established a virtual forum and an Observatory of Responsible Research and Innovation (RRI) as a means to develop the structure for a network of stakeholders committed to sharing a common understanding in Responsible Research and Innovation across Europe and beyond. Differently, SERSCIDA encouraged debate on open access by focusing on social science data archiving. In terms of outcomes, it fostered the cooperation between three Western Balkan countries (Bosnia and Herzegovina, Croatia and Serbia) with CESSDA[33] and defined a detailed action plan to guide the institutionalisation of social science digital data archives.

[33] Council of European Social Sciences Data Archives (CESSDA).

Has the project achieved the objectives in terms of SaS and SiS activity lines/programme objectives?

On the basis of the 60 SaS-SiS case studies, the research team compared the objectives and results achieved by every project with the objectives defined at activity line/programme level and clustered findings by thematic dimension.

The project achievements were overall in line with the objectives outlined at activity line/programme level for SaS and SiS.

- *Gender and science.* Projects related to gender and science under FP6 contributed to stimulating the participation of female scientists and, to a lesser extent, fostering the integration of gender issues in research. The projects related to gender and science under FP7 contributed to boosting gender mainstreaming in institutions and raising public awareness of gender issues.
- *Science literacy.* Science literacy projects under FP6 contributed to promoting young people's interest in science, whilst also increasing public awareness of scientific advances and their impacts. FP7 science literacy projects contributed to increasing the number of young people pursuing careers in science while maintaining past objectives of increasing awareness.
- *Science and ethics.* Projects under FP6 and FP7 contributed to placing ethics at the centre of science governance. A shift of focus existed in ethics projects, moving from the generation of new knowledge in the ethics field in FP6 to identifying more practical solutions to address ethical issues in FP7.
- *Governance and scientific advice, RRI.* Projects related to governance and scientific advice focused on strengthening an effective and scientific basis for policy decisions in view of achieving responsible research and innovation.
- *Civil society and citizen participation.* SxS projects concretely contributed to promoting dialogue between society and research, by either performing cooperative research or focusing on building networks between local actors that act as intermediaries between the general public and the researchers (such as bodies involved in the organisation of science events).
- *Open access, open science.* Under FP6, projects related to open science only focused on the dissemination of knowledge. Under FP7, projects also aimed to encourage debate on information dissemination.

4.1.3 Best practices

Which projects have shown outstanding or path-breaking advancements with a view to new ways of undertaking or governing research activities (stakeholder involvement, participatory processes, impact on policy, indicator development, etc.)? What made them successful?

The study identified, through the survey and the case studies, many innovative SxS project approaches. Innovations rely on the involvement of relevant stakeholders, dissemination activities and the creation of partnerships. A significant part of the innovation in the SxS projects was in terms of engaging relevant stakeholders (65% of the respondents from SxS projects voted "high" or "very high") and in terms of the ways partnerships were created in the consortia (55% of the respondents from SxS projects voted "high" or "very high").

These projects enabled the development of new methods to involve stakeholders such as communities of practice and groups of young researchers to drive research in a given field. In addition, the programmes also provided opportunities to involve new stakeholders in research (for instance patient organisations). New partnerships included the creation of networks of actors which were not used to working together, such as academic and non-academic organisations and some public and private companies, policy makers and scientists, as well as the establishment of long-lasting relationships between existing networks in Member States.

More than half of the respondents to the survey (60%) considered their projects to be innovative in the dissemination activities adopted, with an increased use of social media and websites through appropriate support (videos, broadcasts or on-line applications). However, as presented in previous sections, the use of social media remained limited overall.

41% of the SxS participants and coordinators reported their projects as having contributed to a large or very large extent to innovating the content of research in their field: important achievements in the development of new methodologies and new tools that may be adapted for other projects were identified. This was especially the case of projects related to "science literacy", which developed new training methodologies (e-learning or collaborative learning).

The most important success factors were identified in the skills of the people involved (64% of the respondents from SxS projects voted "high" or "very high") and the networks of contacts (56% of the respondents from SxS projects voted "high" or "very high"). This is consistent with the results of the analysis undertaken on the composition of the teams, which showed how SxS projects are characterised by higher seniority and expertise (in terms of PhD) of team members in comparison to "other" FP projects. Only a residual share of respondents considered the use of new technologies as a factor contributing to the success of their project. This is indeed consistent with the analysis of the composition of teams presented in the previous chapter.

The most frequent path-breaking advancement observed in the case studies is the involvement of unusual and relevant stakeholders at different stages of the project cycle: either in the research team (end-users, citizens, civil society, policy makers, specific groups representatives), amongst the consulted stakeholders, or for final dissemination. 30% of the analysed projects cited the involvement of stakeholders as a path-breaking advancement in their projects, and this result is homogeneous across dimensions. The participatory process was also listed as innovative in 20% of the projects analysed. Those projects used a variety of tools to stimulate active participation from the target groups (citizens, women). The most innovative tools to widen participation in research projects can be found within the dimension "science and society", with the use of café sessions, festivals, contests, travelling exhibitions. For other projects, innovation mainly consists in the association of unusual stakeholders at an early stage of the research project (general public, end-users, civil society). Most innovative projects with an impact on policy were found in the "gender and science" dimension and were mostly aimed at mainstreaming gender issues in the political and research agenda. The development of indicators was mentioned as a path-breaking advancement for projects in the "gender and science" dimension only.

Box 3 - Some projects that contributed to a path-breaking advancement in SxS

Gender and science. In 2005, PLATWOMSCI established the EPWS as a non-profit making association. Designed as a "network of networks", the EPWS acted as a broker between the research community and policy makers involving also media and the general public. The EPWS influenced EU research policy by means of position papers, replies to public consultations and official papers,[34] becoming a key strategic actor in the research policy debate.[35] Today, the EPWS is an international non-profit organisation comprising more than 100 member networks in 40 countries representing over 12,000 female researchers.

Open access, open science. SERSCIDA made a valuable contribution towards the institutionalisation of a long-term international cooperation on existing social science data archives in European Union/CESSDA countries. It worked with regional science and research funding bodies to enhance their understanding of the costs/benefits of supporting sustainable data services and with the national and regional statistical bureaux. By increasing awareness of the relevance of digital data archives for social science research, it encouraged data sharing and open access policies in social sciences within and between the Western Balkan countries. The involvement of public policy makers at different stages of the project through round tables, meetings and events was appreciated by government officials who committed to improving the quality of data and to promote work at government level.[36] This approach involving intensive training, the development of a technical infrastructure and outreach activities proved effective, and could be extended to other countries with no existing data services.[37]

Science literacy. PROFILES was regarded as a "model to guide" stakeholders[38] (e.g. students, science teachers, science educators, researchers and scientists) in recognising the value of student-centred approaches to learning in modern science education. As a remarkable success, approximately 3,100 stakeholders provided their feedback and shared their views on desirable science education within the PROFILES Curricular Delphi Study on IBSE agreeing on some relevant aspects. Due to national stakeholder meetings, the PROFILES Networks reached almost 21,400 stakeholders, 2,450 educational institutions and 160 non-educational institutions by April 2015.

Science and Ethics. The BIONET project identified opportunities and limitations of introducing ethical governance relating to a highly controversial R&D area. It became clear through the BIONET project that recent ethical guidelines and respective regulations are not sufficient for a number of reasons which the BIONET project explored. In three years with a rather moderate budget of less than €750,000, the BIONET project was able to implement considerable activities (website, workshops and conferences, expert group set up, student exchanges, reports). The project was carried out involving a broad range of stakeholders, amongst them representatives from high-impact organisations from European countries and China. The BIONET project deliverables included a textbook on the Ethical Governance of Research in Life Sciences and Biomedicine and a best practice guide for European-Asian biomedical research collaborations.

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[34] A full list of submitted documents is available on the EPWS website (http://epws.org/epws-position-papers-and-policy-statements/)
[35] As described in the EPWS website: http://epws.org/epws-today/
[36] SERSCIDA (2013).Conference Report, pag. 9-10.
[37] Information retrieved form: http://seedsproject.ch/?page_id=2.
[38] PROFILES Final Report Summary available at: http://cordis.europa.eu/result/rcn/173814_en.html.

Governance and scientific advice, RRI. The NERRI project produced two relevant advancements with regards to RRI in the field of neuro-enhancement. First, NERRI contributed to facilitating wide, open dialogue about the benefits and the risks related to enhancement technologies by enabling and inviting future participants in the debate to take position. In this highly contested field this is an important contribution and an important shift of focus – away from straightforward, quantitative recommendations – towards deliberative processes to assess and evaluate technological innovation against the background of fundamental values. Secondly, NERRI developed Mutual Learning Exercises (MLEs) as an important tool and methodology to deal with the challenges of such deliberation processes in practice. Whilst there may be broad agreements about the importance of fundamental rights, they are often articulated differently in various contexts and it is rarely evident how certain values should be applied, to whom, and when in specific social contexts like education, healthcare, and the workplace.

Civil society and citizen participation. The FAAN project can be considered path-breaking in terms of informing and designing a methodology for co-operative research involving academic and non-academic stakeholders. Furthermore, the project proposed a trans-disciplinary approach in co-operative research as a tool for including different voices within a more democratic production of knowledge.

Which projects are best-practice examples of initiatives, actions or cross-thematic partnerships with other parts of the Framework Programme? What made them so?

The analysis of the case studies highlighted successful examples of initiatives, actions and cross-thematic partnerships developed with other parts of the Framework Programme. These examples can be replicated and seen as best practice for other projects. They include the involvement of project participants in international networks and co-publications and collaborations with other project participants outside the SaS/SiS programmes. Previous collaborations with other universities and RTOs within and outside the FPs is the key to fostering such cross-thematic partnerships.

Since the projects were led by a consortium of researchers and other stakeholders from various entities, the links with other projects were rather straightforward, at least informally, and contributed to the dissemination of SxS results towards the scientific community. The large majority of projects formally interacted with other SxS projects during their implementation, by participating in project networks and sharing their results.

The interactions were mostly limited to other SxS projects and conferences directly linked to the core research in the case of "gender and science" projects. By contrast, other dimensions disseminated their results outside their sphere of competences. This is particularly the case for "open access, open science" projects, where several interacted with "other" non SxS projects, thereby demonstrating a high level of maturity of the scientific community relating to this dimension. The most significant example is the ESCW project which involved different FP6 project researchers in science communication workshops aimed at improving their communication skills. The project collaborated with other EU projects to train researchers from different FP6-funded networks (e.g. EuroPlaNet, CareMan, Lipgene and QUASAAR), contributing to a wider community-building process in science communication.

The capacity to bridge the gap between civil society, public and science of projects related to "civil society" and "science and literacy" is a significant achievement that can be considered as a best practice *per se*. The partnerships with other FP6/FP7 thematic areas were rare with the exception of thematic projects (e.g. NANOEIS and FOODLINKS).

Box 4 - Examples of cross-thematic partnerships

Gender and science. Some of the EU projects funded in FP6 and FP7 contributed to promoting gender issues. Developing cross-thematic synergies between projects from different parts of the programmes was key to scaling up their impacts. Overall, contacts were frequently established in the form of information exchange between project teams, informal consultations, and participation in project events. Cross-thematic partnerships and other forms of institutionalised arrangements between different parts of the FPs were not reported in project documents. An example of cooperation for dissemination between different FP programmes is provided by the GENDERTIME project whose partners participated in a public event organised by the FP7 People project NEAR (North EAst Researchers' Night).[39] In particular, a GENDERTIME short conference was held during the NEAR in Padua (IT) in 2013.

Open access, open science. The RESPONSIBILITY project led to synergic activities with other four FP7 SiS projects dealing with RRI (GREAT,[40] Res-Agora,[41] PROGRESS,[42] and Responsible-Industry[43]) starting the Go5 (Group of five) in September 2013. Coordination was ensured through joint workshops, conference attendance and regular exchange of information. As a result, a glossary task force including members from the Go5 delivered a first version of a common RRI glossary merging terms from all RRI related projects.

Science literacy. Cooperation amongst different EU project teams offered the opportunity to share experiences on new educational practices developed in different contexts. When implemented as a strategy, cooperation was established within the SxS programmes and also with other parts of the FPs. Some examples of best practices were identified amongst the case studies. DISCOVERY DAYS implemented a clustering strategy to promote effective cooperation with other ongoing projects supporting RTD activities within the ERA (ARCHEOGUIDE, ASH, LAB@FUTURE, CREATE).[44] In addition, at the International Conference "eLearning Conference" held in Eisenstadt (AT) in October 2007, the project team networked with participants of other EU funded projects (CALIBRATE, MELT,P2V, EdReNe, COLLAGE, InLoT, INTERREG).[45] The same strategy applied to projects within the SaS programme in view of establishing synergies. For instance, a DISCOVERY DAYS event targeted science teachers, headmasters, and other professionals in the field of science education: the Teachers Conference Discovery Day at Technopolis, the Flemish Science Centre in Mechelen (BE) in June 2007. The conference was organised in parallel with the PENCIL Science Teachers Conference also targeting science teachers in order to build on its audience and maximise project outreach. The Science Teachers Conference was organised within the PENCIL[46] project (Permanent European resource Centre for Informal Learning) which aimed to develop and test innovative methods for science teaching via pilot projects. In addition, DISCOVERY DAYS tried to bring together project teams from different technological, educational and cultural fields to exchange

[39] FP7-PEOPLE-2013-NIGHT. Project ref.: 609800.
[40] FP7-SCIENCE-IN-SOCIETY-2012-1. Project ref.: 321480.
[41] FP7-SCIENCE-IN-SOCIETY-2012-1. Project ref.: 321427.
[42] FP7-SCIENCE-IN-SOCIETY-2012-1. Project ref.: 321400.
[43] FP7-SCIENCE-IN-SOCIETY-2013-1. Project ref.: 609817.
[44] IST-1999-11306, IST-1999-10859, IST-2001-34204, IST-2001-34231, respectively.
[45] As reported in the Discovery Days Final Report available at (http://cordis.europa.eu/docs/publications/1267/126792741-6_en.pdf).
[46] FP6-2003-SCIENCEANDSOCIETY-5. Project ref.: 511165.

visions and perspectives on the future visitor's experience. More than six EU projects were presented at the Ecsite Annual Conference in Lisbon (PT) in 2007, bringing together teams of experts in technological development (for the AquaRing project, for example), formal/informal learning (HANDS-ON & BRAINS-ON,[47] PENCIL).

Governance and scientific advice, RRI. The MIDIR project can be seen as a best practice example, especially with regards efforts to establish cross-thematic partnerships with other activities in the FP6-SaS WP. A key element of MIDIR was analysis of other existing approaches in the field of risk and uncertainty management. To that end, other SaS funded projects were reviewed, e.g. STARK, TRUSTNET-IN-ACTION and RISK NETWORK. Attention was also paid to European and international scientific communities and policy networks in the field of risk governance. The project partners participated, for example, in the European Workshop on Interdisciplinary Research on Risk and Governance, held in June 2004 in Brussels. The workshop was organised by the International Risk Governance Council.

Civil society and citizen participation. The FOODLINKS project exploited outcomes of the FAAN project regarding the survey of AAFNs in Europe, and explicitly adopted FAAN's recommendations to relevant stakeholders within its own set of recommendations regarding short food supply chains as drivers of sustainable development.

4.2 Evaluation at programme level

4.2.1 Evolution of the programme objectives and priorities

Did the content and understanding of thematic action lines evolve over the years, going from the beginning of FP6 to the end of FP7? If so, to what extent? (for example, did themes appear, disappear and/or reappear over the years?

Activities and areas in the SaS and SiS Work Programmes evolved over time, but not necessarily taking a clear-cut and consistent development path. While some of the activities and areas disappeared, others multiplied and branched-out. This dynamic evolution occurred in different forms, by shifting priorities, merging areas, and developing long-lasting thematic clusters.

From the beginning of FP6 to the end of FP7, the content and understanding of thematic action lines substantially evolved with an increased matching of the financed scientific research with societal needs, especially since the introduction of the Responsible Research and Innovation (RRI) policy.

The SaS programme was structured into three action lines.

- **Part A: Bringing research closer to society**: This action line was mainly focused on aspects of science governance, with attention paid to societal engagement in research. Its activity line "*Scientific advice, governance and reference systems*" aimed to create the most effective conditions to meet society's needs in multi-level governance policy decisions. Through the SaS programme, there is no specific evolution within this action line. It remained stable in its objectives and expected impacts;

[47] FP6-2004-SCIENCE-AND-SOCIETY-11. Project ref.: 19154.

- **Part B: Responsible research and application of science and technology**. This action line focused, at first, on two streams: (i) the relationship between ethics and research; and (ii) aspects of uncertainty, risk, and implementation of the precautionary principle in policy making. This second stream was, however, clearly closer to the aspects of governance and policy making, and was therefore merged into the first action line starting from the SaS WP 2005. The ethics theme evolved over time. Compared to the first formulation of the "*4.3.2 Ethics*" Activity Line set out in SaS WP 2003, the subsequent SaS WPs were characterised by two different and more specific elements: (1) an emphasis on the diversity in the cultural backgrounds across the continent, although with an explicit reference to the European, cross-country dimension of so-called fundamental ethical principles; (2) a direct reference to the European Research Area;
- **Part C: Stepping up the science/society dialogue and women in science**. This action line developed into two activity areas: (i) scientific and technological culture, aspects of science education, and careers in science; and (ii) issues related to women and science. The latter activity area did not evolve through the programme. It kept its focus on the objective of boosting gender equality in research and fostering the integration of the gender dimension throughout European research. On the contrary, the first activity increased its focus on facilitating dialogue and communication flows between citizens and the scientific community at large, as well as on networking of existing organisations dealing with science and education. This trend, which began under the SaS programme, was further reinforced under the SiS programme which gave a prominent role to civil participation.

The SiS programme was mainly an evolution of the topics introduced by the SaS programme and introduced a focus on the new theme of open access relating to the aspects of scientific dissemination and public access to scientific research. The number of action lines increased to four, and the number of activity lines increased from five under the SaS programme to 15. Excluding the action line "Strategic Activities", which grouped *ad hoc* activities of the European Commission, the core action lines were:

- **First Action Line – A more dynamic governance of the science and society relationship**, including aspects of science governance, civil society engagement and the ethics of research which were split into two action lines under the SaS programme (Part A and Part B);
- **Second Action Line – Strengthening potential, broadening horizons.** This action line was a continuation of the "Part C" SaS action on "science literacy" and focused on aspects of "gender and science" (to be noted the use of the term "gender" instead of "women");
- **Third Action Line – Science and Society communicate.** This third action was completely dedicated to scientific communication. The objective was to promote effective two-way communication channels, providing the wider public with more scientific information and enabling the public to engage with scientists.

Analysing the transition from SaS to SiS, it is possible to identify common themes that span across programmes, themes that faded out or new research topics that were added over time. However, in most cases, the topics evolved and a continuity in the objectives of the SaS and SiS programmes was found. A greater importance was given, under the SiS programme, to the activities relating to the involvement of civil society in research and the governance of science. The most relevant themes remained "science literacy" and "gender and science".

A matching analysis between the SaS and the SiS topics has not only shown that only a few SaS topics were discontinued under SiS, but also that several SaS topics were further developed in SiS creating a higher number of areas of intervention. (see Box 5). This means that, although the available budget under the SiS programme was significantly higher, the fragmentation of the intervention also increased.

Box 5 - In depth analysis of programme objectives by dimension

Gender and science. Four clusters of common approach/content were identified in "gender and science" across the SaS and SiS programmes:

- Creation of points of contact, organisational exchange bodies and expert groups;
- Gender equality in policy, science and industry;
- Research on gender issues;
- Measuring and monitoring of gender issues.

The large majority of gender issues addressed by SaS were adopted, continued and enhanced under SiS. However, the focus changed. For example, the creation of points of contacts, organisational exchange bodies and expert groups became more important under SiS. Moreover, SiS moved from the rather general description of tools and new areas of data collection and monitoring to specifically formulated surveys (e.g. SHE Figures). Finally, new topics were introduced, such as "Gender and leadership in medicine" and "Women in science: Euro-Mediterranean Cooperation".

Science literacy. All the science literacy issues addressed by SaS were adopted, intensified and enhanced under SiS, in accordance with the evolution of science education to include a wide variety of topics.

Four clusters of common approach/content of "science literacy" were identified across the SaS and SiS programmes:

- Communication between the scientific community and the general public;
- Scientific prizes and contests;
- School and scientific careers – science education;
- The European Science Week event.
- New topics under "science literacy" included: "Clusters of cities of scientific culture for innovation"; "Europa Diary"; "Identification of trends in scientific studies"; "Support training activities of journalists and authors in Member States and the Associated countries in EC-funded research laboratories"; "Support for training activities for high-level EC-funded scientists"; "Broadcasting Union"; "European Broadcasting Union"; and "Science-Society interaction in the digital technologies era".

Science and ethics. This dimension demonstrates the highest discontinuity from SaS to SiS. The common pattern remained the creation of networks of experts and the organisation of events with a focus on the relationship between science and ethics. Some themes were discontinued, such as (i) comparative research, foresight and impact studies on ethical issues; (ii) research on ethical questions that were not covered by other parts of the Framework Programmes; and (iii) the impact assessment of EU-funded bioethics research. On the contrary, some topics emerged under SiS including a greater interest in (i) privacy issues; (ii) ethical frameworks for new technologies; (iii) the relationship between ethics and security and, (iv) the relationship between ethics and sustainable development.

The FP7 programme encouraged more focused research on the role of ethics under EU policy and law, regulations at the global level, and investigation of ethics capacity integrated in research activities. In the 2007 FP7 WP, the initial focus for ethics was on academic research on appropriate ethical frameworks of new technologies as well as research on the foresight of ethical issues likely to emerge in the context of the societal embedding of new technologies. This changed with a slight shift towards more applied projects and away from strongly academic research, with projects more geared towards providing ethical frameworks for developers of technology and services. One of the interviewed experts acknowledged, for example, that ethics in ICT (Information Communication Technology) and nanotechnology came as new fields of attention, along with bioethics.

New emerging topics under SiS included: “Privacy and emerging fields”; “policy related to ethics, precaution and sustainable development”; “Ethical frameworks of new technologies”; “emerging fields of science and technology”; “Ethics and security”; and “pan-European and international awareness of the ethical aspects of Security technologies”.

Governance and scientific advice, RRI. A high degree of continuity could be observed in relation to the actions under this dimension. The main trends can be summarised as follows:

- Scientific advice and governance, including the development of synergies with national research strategies and the political and legal issues due to the technological development;
- Establishment of expert groups, networks and organisation of events;
- Scientific prizes and contests.

The growth of this dimension under the SiS programme was significant, with the inclusion of several topics, such as (i) RRI and related activities; (ii) the development of methods for measuring societal impacts and emerging scientific and technological developments; and (iii) monitoring the results of the EU programmes.

New emerging topics in this dimension included: “Integrated assessment methods for measuring societal impacts of emerging scientific and technological developments”; “Social Impact Assessment of Research”; “Monitoring Activities on Science in Society (MASIS)”; ”Stock taking and Meta-analysis of SiS projects throughout FP6 and FP7”; “Ex-post evaluation of SiS FP7”; ”Ex-Post and ex-ante impact assessments of Science in Society Action”; “RRI”; ”Eurobarometer on RRI”; ”Governance frameworks for RRI”; ”Coordination of RRI”; “Training and Dissemination Toolkit on RRI”; and “RRI in industrial context”.

Civil society and citizen participation. This dimension witnessed a slight discontinuity across programmes. The budget allocated to projects in this dimension considerably increased and two main trends emerged:

- participation of the civil society (i.e. CSO capacity building; Science Shops);
- communication activities and development of networks.

Looking at the evolution of thematic areas from a content perspective, the study found that although a very high structural continuity is not always given (e.g. by renaming areas and assigning them to activities at other levels), a high consistency of thematic orientation is realised, e.g. by pursuing themes under a different name and clustering them with other thematic areas.

What causes can be identified for such evolution, and what were their implications?

The contents and structure (as activities and thematic areas) of the Work Programmes evolved from FP6 to FP7 to reflect ethical, legal and social aspects in science and research activities in the ERA and embed emerging societal concerns on the relationship between science and society. Interviews contributed to reconstructing patterns and highlighting trends, which increased understanding of the rationale behind this programme evolution.

Gender and science. At the beginning of the FP7 SiS WP, one of the six thematic areas was still dedicated to "women and science". However, in the course of FP7 SiS, the notation changed to "gender and science". This was also reflected in the general development of the gender debate towards a "dual approach". On the operational side, and as expressed by an interviewee, this change was in line with a shift of funding strategies from 'fixing the number' of women employed in science, research and innovation, to 'fixing the institutions'. The latter meant tackling the deeply rooted barriers hindering women's employment and career advancement in science and research which can only be removed through institutional changes (reorganisation of the institutional settings). The third step could be summarised as "fixing the knowledge", referring to the objective of integrating gender analysis into research content and process.

Science literacy. According to a literature review on science education and science literacy of the MoRRI project (2016), there were "two major shifts in the field of science literacy and science education […] over the last three decades: the shift from the deficit model to the dialogue model and most recently to the participation model, which emphasises the co-production of knowledge". Based on this literature review, MoRRI derived three aspects of science education and science literacy:

1. Science education;
2. Science communication;
3. Co-production of knowledge.

The discourse on science education and science literacy is much older than SaS and SiS programming. Evidence does not confirm shifts of emphasis in the SaS and SiS programming, but rather a coexistence of the three education models (deficit model, dialogue model and participation model) and the three aspects, which MoRRI identified.

In SiS, a particular focus on universities can be observed. With the implementation of the Bologna process to strengthen the competitiveness and attractiveness of European higher education, new thematic areas supporting this process were phased in the FP7 SiS programme.

Science and ethics. The consulted stakeholders agreed that ethics in science and technology has become a relevant issue amongst the various research priorities outside the SaS/SiS programmes and the dimension has gone through a "rationalisation" process within the SiS programme. Under SiS, more attention was given to issues such as privacy and security. The reasons for such a change are to be found, as reported by an interviewee, in the broader societal context: (i) security has become a major theme for society as a whole since the beginning of the 2000s; and (ii) privacy has become a more sensitive issue for citizens since the beginning of the increasing diffusion of online social networks and ICT in general. In these terms, the SiS programme followed the emerging societal issues and translated them into the science/society framework. Due to this, the focus of ethics in research and innovation tends to be on newly developed technologies and newly identified risks. According to stakeholders, there is a need to extend the debate about ethics and research beyond high-profile areas of science and innovation towards more mainstream areas such as sustainability, healthcare, and social science research.

Governance and scientific advice, RRI. The evolution of research and innovation governance referring to science in society started in the 1990s with the debate on ELS aspects in science, technology and innovation. The debate motivated an active uptake of ELS issues in science and technology governance. The ELS debate was driven by the emergence of new technologies and areas such as biotechnology, human genome research, nano-technologies, human enhancement, and other areas raising ethical, legal and social concerns.

In the 1990s and early 2000s, sustainable development was conceptualised as economic and societal development within the limits of growth. Forward-looking and precautionary policy approaches were discussed to avoid the risks that could be generated from violating these limits. With the turn in the general discourse on sustainable development towards 'green growth' concepts, the precautionary principle lost its appeal. In the FP6 SaS WP, instead of the precautionary principle, new management strategies and current trends away from risk reduction towards resilient and discursive approaches in research and innovation governance came up.

In the FP7 SiS programme, the main aim regarding research and innovation governance was to broadly stimulate the debate, "with a view to building an open, effective and democratic European knowledge-based society, the harmonious integration of scientific and technological endeavour, and associated science and research policies in the European social web, by encouraging pan-European reflection and debate on science and technology and their relationship with the whole spectrum of society and culture".

Across Europe, the Fukushima accident provoked considerable discussion related to the governance of science and controversial technologies. This led to a broader commitment of most European research funders and research stakeholders to actively govern science, and especially the centrality of ethics within this governance.

Civil society and citizen participation. Under this dimension, as also confirmed by interviewed experts, the main trend was from a one-directional approach (i.e. dissemination activities of project results) towards a more inclusive involvement of civil society representatives in shaping research.

In addition, some interviewed experts underlined the increasing involvement of civil society in the process of innovation: there was a change from technological innovation to social innovation framed by the concept of smart specialisation. However, the majority of respondents did not see a substantial change between SaS and SiS. Some remarks indicated that in several cases respondents considered changes mainly in terms of language and semantics.

When looking at the survey results, the majority of respondents confirmed no major changes occurred at the level of action lines, objectives and areas, moving from SaS to SiS. Some respondents reported a greater emphasis of the SiS programme on the engagement of civil society, in particular regarding the inclusion of CSOs in agenda-setting and citizen participation in research. This was considered to be an important evolution which induced researchers to engage more with civil society and establish a two-way communication. On the contrary, some survey respondents considered this evolution grew at the expense of academic research in the field of ethical, social and legal aspects of new technologies.

Open access, open science. The first official EU document with regards to a stronger science/society integration did not include any actions towards the OAOS dimension in a narrow sense. However, it acknowledged that European citizens *"will need to have information that is understandable and of a high quality, as well as ready access to this specific culture*" (Commission of the European Communities, 2001). In this respect, its formulated actions aimed to improve the dissemination of scientific knowledge.

The open access discourse is relatively new. Interviewees noticed that the concept evolved from an initial policy approach favouring accessibility of research data towards a broader approach of open science, aiming to foster transparency in the whole process of research. As observed by interviewed OAOS experts, this concept has gained increasing importance with a dedicated thematic area of the FP7 SiS WPs. Already reflected in the first SiS WP of FP7, the objective was to create virtual and open source-based venues allowing for an information exchange between scientists and non-scientific experts. In the subsequent SiS WPs, the focus shifted to emerging issues such as "access by the public", "new knowledge policy", and "innovative society". Other efforts arose as well, such as actions to improve the scientific system, measururing scientific impact, evaluation of individual research outputs and the development of other relevant indicators.

Were the insights and 'lessons learned' of SaS FP6 (i.e. via evaluation studies) applied in SiS FP7?

SiS actively responded to the recommendations of SaS Ex-post evaluations in the activity lines of the WPs for the period 2007-2013. Some minor recommendations were not implemented. For example, despite the progress made in clarifying the objectives and monitoring the implementation, FP7 SiS did not introduce pre-defined 'success indicators' to link the activities with high-level priorities and impacts. A relevant improvement was that the SiS programme brought a more structured approach to fostering a systematic collaboration between research organisations, civil society and policy makers in science and research through Mobilisation and Mutual Learning (MML) instruments and RRI.

The FP6 SaS programme was subject to a limited number of interim and ex-post evaluations that adopted different approaches and methodologies to assess the achieved results. Such evaluation studies agreed upon the relevance of the issues addressed by the programme but they also flagged some areas where progress could still be made. To improve the effectiveness of actions and the overall programme outreach in the future, many recommendations were drawn up. Such recommendations were grouped by dimension and compared with the FP7 SiS background documents. Overall, SiS actively responded to the recommendations of the SaS Ex-post evaluations in the activity lines of the WPs for the period from 2007 through 2013. A few recommendations were not fully addressed by the different areas and topics. Additional evidence is provided below for each dimension.

Science literacy: Above all, the first recommendation regarding science education was (1) to better present the programme goals and objectives and make it clear how its actions would have contributed to the desired results, including specific indicators. Efforts to address this recommendation were made in FP7 WPs Activity line 5.2.2. (Young people and science). The objectives pursued by the EU in the field of science education for the period 2007-2013 were stated clearly[48] and the expected impacts of each topic addressed. Despite formal uptake, at the end of FP7 it was still unclear how funded projects contributed to the thematic objectives, thus greater coherence and clarity was suggested (ICF Consulting Services, Delft University, Facts of Life and Technopolis, 2016). Furthermore, FP7 introduced a range of tools to undertake timely monitoring of the progress of the funded actions also involving experts (e.g. a High-Level Group on Science Education was set up during the programme implementation). However, there were no pre-defined 'success indicators' able to make systematic links between high-level priorities, SiS activities, and socio-economic impacts.[49]

Concerning the contents, recommendations were made to (2) address culturally-specific issues of gender and disadvantaged status in European science education, and promote science careers amongst the young. The SiS WPs responded to this need in Area 5.2.2.2 (Reinforcing links between science education and science careers), where special attention was paid to gender-specific differences and the needs of young people from disadvantaged, under-represented, and underperforming groups.[50] In particular, actions specifically aimed to prompt interest in science careers amongst young people from all backgrounds through realistic role models and better information about career opportunities.[51]

In addition, recommendations were made (3) to stimulate initiatives to reform actual teaching practice whilst also providing structures for the professional development of teachers. Efforts to address this recommendation were made in Area 5.2.2.1. (Supporting formal and informal science education in schools as well as through science centres and museums and other relevant means), which supported the use of innovative methods in science education inside and outside the classroom (e.g. IBSE[52] in primary and/or secondary schools). Teacher training activities on such techniques and the establishment networks of European teachers were also promoted Europe wide.

FP7 was also recommended (4) to encourage a broader participation in science education by policy makers and industry; involve students in projects and achieve a better coordination of the activities of DG Research, DG Education and Culture aimed at reforming the existing science teaching practices. To address this recommendation, Area 5.2.2.3 (Research and coordination actions on new methods in science education) stimulated the exchange of knowledge and know-how between practitioners, the science education research community and policy makers and provided mechanisms to inform the decision making process (e.g. seminars, workshops, conferences, data and guidelines).[53] Several grant-funded activities, such as contests and events, directly involved young people in

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[48] The objectives 2007-2013 were: "to contribute to the Lisbon agenda by increasing the number of young people from all backgrounds entering careers in science, research and technology; and, by raising the general level of science literacy to increase awareness of the societal impact of science" (FP7 SiS Work Programme 2007).

[49] Key Performance Indicators (KPIs) for SwafS, RRI and Gender will be introduced only in Horizon 2020.

[50] FP7 SiS Work Programme 2007; 2010.

[51] Ibid.

[52]The Inquiry Based Science Education (IBSE) was identified as specific science teaching methodology by the report "Science education now: a renewed pedagogy for the future of Europe"(published in 2007). Since then, FP7 projects have prompted its large scale uptake.

[53] FP 7 SiS Work Programme 2008.

competitions for prizes and awards requesting them to express their views/concerns about science and society issue. Finally, no evidence of an enhanced coordination effort among the activities of different EC DGs involved in science education was found in available programme documents.

Governance and scientific advice, RRI: Few recommendations were issued for this thematic dimension. These included the need for (1) issues of science communication and scientific advice and governance to concern most Directorates within DG Research, and (2) to gain pre-emptive engagement with target audiences. No evidence concerning the first recommendation was found in SiS programme documents. Differently, the second recommendation was addressed by Activity 5.1.2. (Broader engagement to anticipate and clarify political, societal and ethical issues), which initiated co-operative research activities in societally relevant fields at European level. Partnerships between researchers and non-researchers (namely policy makers, citizens groups, and CSOs) resulted in the articulation of joint solutions to relevant issues.[54] This effort towards a broader public engagement was also embedded in the concept of Responsible Research and Innovation (RRI), which became the heart of SiS's first action line from 2012. The Mobilisation and Mutual Learning instruments (MML) also contributed to the response. They brought a more structured approach to fostering systematic collaboration in science and research and further mobilising research organisations, civil society and policy makers.[55]

Science and ethics. Many areas for improvement were identified by FP6 SaS ex-post evaluations in the field of ethics. With regards to the scope of the dimension, FP7 activities were suggested (1) to cover all areas of ethical novelty rather than just ethical issues in novel science disciplines and (2) to foster cross-disciplinary dialogue in order to integrate ethical issues in a substantial manner throughout the FP. Under FP7, ethics were embedded in the wider issue of governance and, thus, lessons were taken up in the first activity line. Notably, Area 5.1.1.2. (Research on ethics in science and technology) sought to cover all ethical issues by supporting academic research on appropriate ethical frameworks of new technologies and the early identification of ethical issues likely to emerge in the context of the societal embedding of new technologies.[56] Despite the ambition, funded projects focused specifically and exclusively on ethical aspects of research, with innovation evolving later in SiS (ICF Consulting Services, Delft University, Facts of Life and Technopolis, 2016). Furthermore, it stressed the use of participatory processes and multidisciplinary/multi-stakeholder approaches to address ethical principles in various topics and favour a common understanding amongst Member States.[57]

Other recommendations underlined the need (3) to substantially involve members of vulnerable groups in current research on specific ethical issues raised by the impact of technology and (4) to reflect upon the role of the private sector. No strong evidence of specific involvement of vulnerable groups in research was found. However, Activity 5.1.2 supported new ways of involving society at large in setting research agendas and established an ethical review mechanism for all framework research proposals under FP7 SiS to take into account their impacts on vulnerable groups.[58] SiS acknowledged the role of the

[54] FP 7 SiS Work Programme 2007.
[55] FP 7 SiS Work Programme 2010.
[56] FP7 SiS Work Programme 2007.
[57] FP7 SiS Work Programme 2008.
[58] FP 7 SiS Work Programme 2012.

private sector in the context of the Mutual Learning Action Plan (MMLAP), which encouraged partnerships among stakeholders (including industry) for tackling societal challenges throughout the research and innovation process. Knowledge and experience from the private sector was seen as providing potential help to address societal needs.

To contribute to policy making and provide guidance, it was recommended that SiS should (5) relay the activities of funded projects, develop indicators for monitoring developments and map existing good practices in science-related ethics. First of all, FP7 employed a range of tools to relay the progress of the activities that received funding including projects (ICF Consulting Services, Delft University, Facts of Life and Technopolis, 2016). In FP7, ethics was embedded in the notion of RRI to shape new governance frameworks. The SiS FP7 Activity 5.1.1. supported the monitoring of trends and development of the six RRI dimensions at national and European level (MASIS)[59] and the development of metrics and indicators through MoRRI[60], which served as a source for the annual monitoring reports.

Gender and science. A greater effort to tackle the problem of the underrepresentation of women in science was expected in FP7 SiS. Some recommendations on the topics included (1) to focus not just on the participation of women but on more substantive and crucial issues related to gender to gain a strong understanding of the gendered processes/ mechanisms/ values that shape and inform scientific practice; (2) to focus more on qualitative research findings to disclose the hidden discriminatory practices; and (3) to foster scientific heterogeneity to better understand the needs of female scientists. FP7 actions on gender equality did not only focus on attracting and retaining women in Science, Technology, Engineering and Mathematics (STEM). Activity 5.2.1. (Gender and research) enlarged the scope of the action to drive structural change in employment practices and workplace culture in research, integrating equality and diversity.[61] It did so by:

- Analysing European best practices on gender management;
- Encouraging a wide-ranging debate with main actors, mainly private and public research and higher education institutions;
- Stimulating cooperation between research organisations/universities to implement the best systemic organisational approaches to encourage the participation and career advancement of female researchers through tailored multi-annual action plans[62].

With regards to research activities, FP7 supported a study on meta-analysis of gender and science research at national and European level on many topics.[63] Studies also relied on secondary data collection, literature reviews and evaluation of initiatives for the development of mechanisms to support female

[59] Monitoring Research and Policy Activities of Science in Society (MASIS).
[60] ResAgorA monitoring database (MoRRI) available at http://www.morri.res-agora.eu/about
[61] FP7 SiS Work Programme 2007-2013. Area 5.2.1.1 Strengthening the role of women in scientific research and in scientific decision-making bodies.
[62] Action plans involved activities such as: recruitment, promotion, retention policies; updated management and research assessment standards; course content development; leadership development; supporting policies for dual career couples; returning schemes after career breaks.
[63] Such topics included, for instance: (i) horizontal segregation ("choice" issues, causes, perception of SET by girls, etc), (ii) vertical segregation (why few female scientists reach top level positions, glass ceiling, sticky floor, etc.) and (iii) underlying segregation causes and effects (work life balance, pay gap, mobility-related obstacles, etc.). (FP7 SiS Work Programme 2007. Area 5.2.1.2 Gender Dimension of Research.

researchers. An Expert Group on "Innovation through Gender" composed of gender experts (including non-European ones) in the various fields of STEM was established in 2011 to promote the integration of the gender dimension in European research to tackle societal challenges. The heterogeneity of the group served to stimulate diverse thinking and analysis.

Other recommendations included (4) to promote high levels of female participation in FP7, setting specific targets for the participation of women and (5) to provide guidance on how to evaluate gender equality aspects and include them in evaluation reports in view of (6) making FP7 management a model of balanced participation between women and men in science and research. FP7 SiS stated that the pursuit of scientific knowledge and its technical application in society required a variety of talent, perspectives and insights which could be ensured only by increasing diversity in the research workforce. All projects were encouraged to have balanced participation of women and men in their research activities and address gender differences as an integral part of the proposal by including specific Gender Equality Actions.[64] Guidance on how to consider gender aspects in projects was provided as checklist in Appendix 7 of Negotiation Guidance Notes.[65] A total of 665 FP7 projects also set targets to achieve gender balance in the workforce, which is 76% of the completed projects carrying out specific gender equality actions as of December 2014 (ICF Consulting Services, Delft University, Facts of Life and Technopolis, 2016).

To monitor progress towards gender equality, SiS was expected (7) to establish an effective system for collecting gender data and for monitoring progress against targets and (8) to integrate databases of female scientists into mainstream databases used by industries, academia and institutions. FP7 SiS contributed to the definition of an EU-wide monitoring system on the conditions of women in science by developing relevant indicators and data collection systems (She Figures 2009, 2012, 2016). Research project data and studies were collected in databases and made accessible to the public, as in the case of PRAGES project.

FP7 was also recommended to (10) take dissemination more seriously and include it as a core activity in strategies (specifying goals, means and lessons-learned) and (11) to broaden and deepen impact strategies beyond dissemination, involving the public in a renewed dialogue and in connection with stakeholders, to continue monitoring their implementation. In FP7 SiS, dissemination activities at regional, national and/or international level were requested to be included in the proposal as well as periodic and final assessment on the efficiency of the implemented plans. To attain wider impacts across Europe, guidelines were produced for other entities, external to the consortium, interested in similar activities and/or structural approaches.

Civil society and citizen participation. In all WPs, it was recommended that SiS should (1) clearly indicate the importance of involving, and engaging in dialogue with, all relevant stakeholders from the public and private sectors and from civil society; in particular, (2) to encourage the involvement of relevant CSOs and (3) to extend the composition of networks and platforms to include all relevant stakeholder groups, including CSO representatives. Enhancing public engagement and the participation of CSOs was a clear objective of Activity 5.1.2 throughout the period 2007-2013. SiS initiated co-operative research processes

[64] FP7 SiS Work Programme 2011.
[65] http://ec.europa.eu/research/participants/data/ref/fp7/89630/negotiation_en.pdf

at European level by establishing partnerships between researchers and non-researchers (notably policy makers, citizens and CSOs). By combining their skills, knowledge and understanding of specific societal issues, relevant actors were engaged in the development of concrete solutions and/or substantiate options in projects.[66] In fact, FP7 specifically encouraged the involvement of civil society actors at different stages of the research process: designing research agenda, undertaking research, and assessing and using results.[67] In addition, MMLAP partnerships were expected to include different types of actors including CSO to set up frameworks of collaboration, networks, public forums, and platforms.[68]

Other recommendations focused on evaluation, which should (4) include the assessment of the stakeholder dialogue strategy[69] and (5) provide guidance and good practices of stakeholder dialogue on SiS websites. MMLAP aimed to contribute to further incorporating SiS issues into research systems. To achieve this, MMLAP developed a communication strategy and activities which took into account the different targeted audiences and actively involved the various partners. Proposals also included a methodology for impartially assessing the implemented activities and dissemination plans, throughout the duration of the project, in relation to their objectives and expected impacts. Networking and exchange of best practices was also key.

Open access, open science. Efforts in this dimension were mainly related to dissemination. SiS was expected (1) to emphasise the importance of the dissemination issue and (2) to elaborate and validate a set of robust indicators and practical tools for assessing the impact and effectiveness of communication that reflected the multiple points of view of relevant actors and stakeholders.

Above all, FP7 was required to establish a dissemination plan (including socio-economic impact and target groups for the results of the research) on any project.[70] The plan specified the dissemination activities and scientific publications as well as the exploitable foreground and the plans for exploitation. Coordinators were required to make the contents of the plan freely available. As expected, there was considerable dissemination activity in SiS projects (ICF Consulting Services, Delft University, Facts of Life and Technopolis, 2016).

Concerning the assessment of impacts, due to the lack of tools and standard indicators, it was not possible to monitor impacts or to relate wider socio-economic trends back to the dissemination/communication activities carried out.

Box 6 - Focus on previous recommendations to improve the SiS programme

General recommendations concerned the overall development and implementation of the SiS programme.

With regards to the design, it was essential (1) to broaden the scope of the future programme to research activities to enhance the knowledge base, as well as foresight

[66] FP 7 SiS Work Programme 2007.
[67] FP 7 SiS Work Programme 2011.
[68] FP 7 SiS Work Programme 2013.
[69] Looking for instance at: the matching between the strategy and its expected contribution to research; clarity of definition of target stakeholders; appropriateness of time and budget allocations; methods used to involve/conduct dialogue; adequacy of the skills and management arrangements within the partnership and team to implement stakeholder dialogue activities.
[70] Guidance Notes on Project Reporting (2012). Available at: http://ec.europa.eu/research/participants/data/ref/fp7/89692/project-reporting_en.pdf.

activities and (2) to include new topics (e.g. actions on "transversal" issues) and more intensive activities in the area of scientific culture.[71] In addition, (3) all Work Programmes should contain an explanation of the policy context, objectives and address relevant SiS issues. The new programme for 2007-2013 built on the actions undertaken under FP6 SaS but also changed perspective somewhat. SiS recognised that research activities were a specific type of social activity embedded in a wider societal context and thus, it directly supported research. New and emerging topics included for instance: multidisciplinary research addressing science/society interactions as a system; and cross-thematic and integrated actions.[72] SiS sought to strengthen the links between science and society by setting a range of research-related societal issues at the top of the policy agenda.

Additional effort was also needed (4) to integrate SiS issues in FP7[73]and build knowledge and capacity on SiS issues in National Contact Points (NCP) for FP7. From the first year on, SiS announced the adoption of measures to promote, support and monitor cross-thematic partnerships of mutual benefit (through, for instance, conferences, studies and analysis) and ensure a degree of coordination in particular with the themes of the Specific Programme "Co-operation". Moreover, Area 5.4. sought to reinforce the NCP network for FP7 under SiS by promoting trans-national co-operation on initiatives (e.g. benchmarking, joint workshops, training, and twinning schemes) and the sharing of good practices in order to help less experienced NCPs grow capacities.[74]

A greater effort needed to be devoted (5) to extend the diversity of partners involved in the programme through participative methodologies and (6) to engage national funding agencies and policy-making institutions to achieve the planned complementarity and greater coherence at national and local level. SiS systematically established new frameworks of collaboration and multi-stakeholder partnerships (e.g. MMLAP) in order to foster the exchange of expertise and knowledge to tackle societal challenges. Specific initiatives focused on CSO capacity building and their involvement in research. In fact, civil society was not conceived as a constraint, but as a driver of innovation and thus an active player in building a democratic knowledge society.

Other recommendations included (7) to make the information on the objectives and ongoing activities of the programme more widely accessible and (8) to make a greater effort to improve the dissemination of the outcomes of the programme including the results and findings of individual projects. The SiS Third Action Line specifically promoted two-way communication channels that enabled the public to engage with science and *vice versa*. An enhanced democratic debate with a more engaged and informed public was deemed key to establishing better conditions for collective choices on scientific issues. All projects were thus encouraged to make their results accessible to the public via websites and social media.

SiS should also include (9) a specific action to define an effective monitoring system – to collect and assess data and information on the integration of SiS aspects and a limited number of specific, substantial and robust indicators. FP7 introduced a centralised annual monitoring system, supported by DG RTD, to report on progress at the level of FP7 as a whole: project implementation (proposals, projects, participants,

[71] In order to: (a) develop a better understanding of the role of science (b) envisage new channels for a better dialogue between scientists and the public (c) promote innovative methods for the public accountability of science, (d) to demonstrate more effective approaches to better integrate Science into publicly visible Creative Culture.
[72] FP7 SiS Work Programme 2007.
[73] The following were identified as essential for the purpose: clear and precise definitions of the various science in society issues, understandable to scientists and scientific policy makers; Convincing arguments and demonstrations of the relevance of Science in Society issues to FP7 programmes and projects, highlighting links to the Lisbon strategy, scientific excellence and impact; Practical examples of how Science in Society issues can be addressed in mainstream scientific research, along with useful links to further information and tools.
[74] FP7 SiS Work Programme 2007. Area 5.4.0.1/5.4.0.2

expenditure), project progress as requested by the Guidance Notes on Project Reporting[75] (timing, expenditure, reporting), the production of outputs (publications, patents, licences) and the dissemination of results (conferences, websites, newsletters, etc.). Specific SiS activities focused on promoting, supporting and monitoring the uptake and impact of SiS issues in other parts of the FP.[76] However, as underlined by ICF's ex-post evaluation, the monitoring tools solely focused on reporting activities and outputs, with no pre-defined robust indicators of success thus hindering the evaluation of overall impacts and results (ICF Consulting Services, Delft University, Facts of Life and Technopolis, 2016). Thus, the uptake of such recommendations was rather low.

In terms of operational recommendations, it was essential (10) to provide a guidance to proposers including an explanation of SiS issues, their policy relevance, measures and sources of information and (11) to re-examine the criteria that are applied for the evaluation of proposals including: (a) a detailed plan for the dissemination of results and findings with a description of specific means; (b) the European added value of a project. Under each activity line, SiS WPs provided participants with sections dedicated to the topic description and the expected impacts but there was no clear explanation of their policy relevance. SiS specified the evaluation procedure for proposals and explained the eligibility and evaluation criteria for proposals in Annex 2 to the Capacities WPs[77] and in the Guides for Applicants. Such criteria included, amongst others, the relevance to the objectives for the topics of the WP and for the objectives of the call, as well as the potential impact through the development, dissemination and use of project results. The Guide also requested applicants to specify the measures they intended to use and how they would increase the impact of the project.[78]

4.2.2 Coverage of programme objectives

Do the funded projects cover the whole spectrum of SaS/SiS objectives? For instance, did the ethics, public engagement, governance, gender, etc. dimensions in research content evolve (increase, decrease) in SaS/SiS projects between FP6 and FP7?

The projects funded both under SaS and SiS covered the entire the spectrum of SaS/SiS objectives. However, some research content topics received more attention - and more funding - while others decreased over time. As shown in Figure 28, at least one project was funded in all the Activity Lines and the Thematic Areas of both SaS and SiS programmes.

[75] http://ec.europa.eu/research/participants/data/ref/fp7/89692/project-reporting_en.pdf
[76] FP7 SiS Work Programme 2007.
[77] Web source: http://ec.europa.eu/research/participants/data/ref/fp7/132038/capacities-general-annexes201301_en.pdf
[78] Web source: https://ec.europa.eu/research/participants/portal/doc/call/fp7/fp7-science-in-society-2013-1/32897-ca_annexes_sis-2013-1_final_en.pdf

Figure 28 - Allocation of EC contribution per Thematic Area (SaS and SiS)

Row Labels	Sum of Amount of EC contribution (€)
SAS	**76 725 083**
PART A: BRINGING RESEARCH CLOSER TO SOCIETY	**6 875 976**
4.3.1.1 Creating a more dynamic interface between science and policy making/integrative approaches to risk governance	1 915 260
4.3.1.2 Encouraging the active participation of society at large in policy development	2 847 600
4.3.1.3 Operation of the European Research Advisory Board (EURAB)	98 080
4.3.1.4 Increasing the societal relevance of research	1 093 741
4.3.1.5 Science Shops: research for local civil society	551 383
4.3.2.1 Dialogue and information exchange between groups concerned with ethical issues	369 912
PART B: RESPONSIBLE RESEARCH AND APPLICATION OF SCIENCE AND TECHNOLOGY	**19 595 500**
4.3.2.1 Dialogue and information exchange between groups concerned with ethical issues	3 661 722
4.3.2.2 Raising the awareness of researchers on ethical issues	848 919
4.3.2.3 Deepening the understanding of ethical issues	14 247 368
4.3.3.1 Strengthening synergies between national approaches through promoting methodologies for addressing scientific uncertainty, risk governance ar	837 491
PART C: STEPPING UP THE SCIENCE/SOCIETY DIALOGUE AND WOMEN SCIENCE	**50 253 607**
4.3.4.1 Promoting science and scientific culture	13 489 693
4.3.4.2 Awards for achievements in scientific collaboration and science communication	1 560 724
4.3.4.3 Promoting young people's interest in science, science education and scientific careers	18 078 477
4.3.5.1 Stimulating the policy debate at national and regional level and mobilisation of women scientists	8 394 928
4.3.5.2 Developing a better understanding of the gender issue in scientific research.	7 478 336
4.3.5.3 Promoting the enhancement of the Gender Watch System and associated activities to promote gender equality throughout the European Resear	775 466
4.3.6.1 Promoting the 'embedding' of science and society issues across the Framework Programme	175 983
4.3.6.2 Mobilising European actors to develop and pursue strategic goals around a Science and Society agenda	300 000
SIS	**288 496 494**
5.1 A more dynamic governance of the science and society relationship	**146 678 795**
5.1.1.1. Research on relationships between science, democracy and law	25 223 249
5.1.1.2. Research on ethics in science and technology	12 072 237
5.1.1.5 Public understanding of science and promotion of public debate	2 759 672
5.1.2.1 Developing governance on science-related questions/Broader engagement on science-related questions	11 300 802
5.1.2.2 Conditions for an informed debate on ethics and science	4 636 573
5.1.2.3 CROSS THEMATIC ACTIVITIES "ENVIRONMENT and ENERGY" and "NANOTECHNOLOGIES"	1 674 123
5.1.3.1. Encouraging the debate on information dissemination, including access to scientific results and the future of scientific publications, taking also i	13 011 715
5.1.3.2 Promoting trust and self-regulation in the scientific community	1 243 777
5.1.3.3 Improving the use, and monitoring the impact, of scientific advice and expertise for policy-making in Europe (including risk management), and de	943 271
5.1.3.4 The reciprocal influence of science and culture	3 687 582
	70 125 795
5.2 Strenghtening potential, broadening horizons	**116 336 050**
5.2.1.1. Strengthening the role of women in scientific research and scientific decision-making bodies	26 124 660
5.2.1.2 Gender Dimension of Research	4 685 709
5.2.1.3 Mainstreaming gender in Community research policy and programmes	2 690 960
5.2.2.1. Supporting formal and informal science education in schools as well as through science centres and museums and other relevant means	52 670 197
5.2.2.2 Reinforcing links between science education and science careers	5 217 490
5.2.2.3. Research and coordination actions on new methods in science education	23 401 814
	1 545 219
5.3 Science and society communicate	**22 227 027**
5.3.0.1 The provision of reliable and timely scientific information for the press and other media	179 680
5.3.0.2 Training actions to bridge the gap between the media and the scientific community targeting the public	4 533 876
5.3.0.3 Encouraging a European dimension at science events targeting the public	11 921 834
5.3.0.5 Promoting excellent trans-national research and science communication by the means of popular prizes	3 000 000
5.3.0.6 Research aimed at enhancing inter-communication concerning science, both in its methods and its porducts, to raise (...)	2 591 637
5.4 Strategic activities	**3 254 622**
5.4.0.1 National Contact Points transnational cooperation	1 201 890
5.4.0.2 Structuring activities	973 302
	1 079 430
Grand Total	**365 221 577**

Source: Authors' elaboration based on eCorda data

Funding variance is very high. The themes that received most funding were:

- "Promoting young people's interest in science, science education and scientific careers" and "Promoting science and scientific culture" under the SaS programme; and
- "Supporting formal and informal science education in schools as well as through science centres and museums and other relevant means" and "Strengthening the role of women in scientific research and in scientific decision-making bodies" under FP7 SiS programme.

On the contrary, themes that received less funding included:

- "Promoting the 'embedding' of science and society issues across the Framework Programme" and "Mobilising European actors to develop and pursue strategic goals around a Science and Society agenda" under the SaS programme; and
- "The provision of reliable and timely scientific information for the press and other media" and "Improving the use, and monitoring the impact, of scientific advice and expertise for policy making in Europe (including risk management), and developing practical tools and schemes (e.g. electronic networks)" under SiS programme.

Box 7 provides further analysis of the coverage of the specific objectives clustered by dimension along with the related number of projects funded for each thematic area.

Box 7 - Coverage of specific thematic objectives by dimension

Gender and science. The total budget allocated in both programmes reached €50 million financing 35 projects under the SaS programme for a total of €16.6 million, and 22 projects under the SiS programme for a total of €33.5 million. The budget increase and the reduction of the number of funded projects led to an increase in the average size of projects, going from nearly €500,000 under the SaS programme to more than €1.5 million under the SiS programme.

The main objectives of the activities in the WPs belonging to this dimension were (i) the creation of contact points of contact, organisational exchange bodies and expert groups focusing on the gender issues in research; (ii) supporting gender equality in policy, science and enterprises; and (iii) conducting research on gender issues. There was a decrease in the number of funded projects from SaS to SiS, whilst the overall amount of funding doubled. Looking at the patterns of funding distribution, under the SaS programme, most funding was allocated to two thematic areas: (i) "4.3.5.1 Stimulating the policy debate at national and regional level and mobilisation of women scientists", which financed 19 projects for a total of €8.3 million; and (ii) "4.3.5.2 Developing a better understanding of the gender issue in scientific research", which financed 14 projects for a total of €7.5 million. Thus, the SaS programme did not focus on a specific objective but rather developed a double track: support the mobilisation of female researchers seeking the active participation of women and, concurrently, develop and collect data on gender issues in scientific research to have a better understanding of gender equality issues in research. The SiS programme took a step further by concentrating 78% of the funding under one thematic area "5.2.1.1 Strengthening the role of women in scientific research and in scientific decision-making bodies", which financed 16 projects for a total of €26.1 million, and focusing the efforts on achieving an impact on the institutional settings that hinder gender equality in research institutions.

Civil society and citizen participation. The total budget allocated in both programmes exceeded €32 million, with 15 projects under the SaS programme financed for a total of nearly €5 million, and 26 projects under the SiS programme totalling more than €27 million.

The main objectives included in this dimension were, under the SaS programme, (i) "4.3.1.2 Encouraging the active participation of society at large in policy development" receiving nearly €3 million and (ii) "4.3.1.4 Increasing the societal relevance of research" receiving a million euros in total. Similarly, under the SiS programme, but with much higher budgets: €11 million to the theme "Broader engagement on science-related questions" and nearly €12 million to the theme "Encouraging a European dimension at science events targeting the public".

Governance and scientific advice. This dimension incurred a tenfold increase in its budget: from just €2.8 million under the SaS programme to €28.5 million under the SiS programme. Nearly 90% of the budget was allocated to projects conducting "Research on relationships between science, democracy and law".

Open access, open science. The most relevant thematic area of the SiS WPs relating to Open access, open science aimed at "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". In the period 2009-2013 SiS supported 11 projects relevant to this dimension for a total of €13.3 million. The objectives covered included:

- The creation of networks of experts supporting the development of research and policy agendas in the area of scientific publishing;
- Providing insights into the dynamics of the European science and research system and the ways in which research outputs, at individual researcher level, are ensured and evaluated;
- Support to the European Commission's policy making on open access to scientific data;
- To spread/increase knowledge of open access related issues in order to reach a wide range of communities and geographic areas and contribute to changes in behaviour that are consistent with the ideals underlying open access.

Science and ethics. The number of projects relating to this dimension decreased from SaS to SiS (from 36 to 23). However, the overall amount did not decrease and remained stable at nearly €20.5 million under both programmes.

Under the SaS programme, the most funded thematic area was "Deepening the understanding of ethical issues" (under which 18 projects were funded for a total of €14.2 million). The main objectives of the funded projects included, for example, the identification of cross-cutting ethical questions relevant to a number of research areas (e.g. information society, nanotechnologies, human genetics and biomedical research in food technologies). A further objective was to conduct research into the ethical issues generated by international scientific and technological co-operation with both developing and industrialised countries, to better understand the implications of legal and cultural differences.

The SiS programme concentrated a large share of funding on the thematic area: "Research on ethics in science and technology" which mainly focused on (i) promoting a closer coordination and collaboration between bodies that perform ethical reviews; and (ii) contributing to the quality of research in the field of ethics of new and emerging fields of science and technology and to the early identification of ethical issues and their relevance to EC policy. 15 projects were funded under this theme, for a total amount of €12 million.

Science literacy. The number of projects relevant to this dimension decreased from

SaS to SiS (from 63 to 55) while the number of thematic areas increased (from three to eight). This means that:

- The average size of projects increased from SaS to SiS (from around €525,000 to €1,700,000);
- The fragmentation of the funding increased under the SiS programme (especially due to the inclusion of the "Science Communicate" Action Line).

The most funded objectives under the SaS programme were, as mentioned above, (i) "4.3.4.3 Promoting young people's interest in science, science education and scientific careers", for a total of 20 projects; and (ii) "4.3.4.1 Promoting science and scientific culture", for a total of 39 projects. While, the most funded objectives under the SiS programme were: (i) "5.2.2.1. Supporting formal and informal science education in schools as well as through science centres and museums and other relevant means", for a total of 19 projects; and (ii) "5.2.2.3 Research and coordination actions on new methods in science education", for a total of 12 projects.

Did the content and understanding of themes in projects and activities evolve over the years, going from the beginning of FP6 to the end of FP7? If so, to what extent? (For example, did themes appear, disappear and/or reappear over the years?) What causes can be identified for such evolution, and what were their implications?

Stakeholders interviewed shared the view that the impact of projects and activities of SaS and SiS in relation to other driving forces was difficult to distinguish. However, the knowledge created in science/society activities most likely had an impact on programming and overall policy development, which often depended on the individual projects and their dissemination activities. Interviewees found it hard to tell whether the developments were driven by the SaS and SiS programmes or national programmes. Probably, an interaction between the EU and national levels contributed to discourses and themes in projects and activities, but most of the interviewees agreed that both EU and national strands developed in parallel and strengthened each other. This co-evolution of projects and discourses is complex, which is why it is difficult to establish a direct causal link between projects and discourses, and policy developments. Depending on the individual project and project output, the attitude of project coordinators was also mentioned as a contributing factor. There can be impacts, but neither necessarily planned nor guaranteed. Interviewees consider that the added value of SaS/SiS projects lies primarily in the possibility to create connections and networks amongst researchers, citizens and ideas across Europe and beyond. Indeed, this allows to determine the evolution of the content and understanding of concepts and issues addressed by projects and activities.

With regards to open access, for instance, the initial content and understanding of the concept referred to the need to change the business models of the publishers since researchers were not able to access scientific documents. This included the involvement of libraries to consider subscription costs. The next step was to address open access to data. Today, the discourses are driven by the need for open access on a global level, and the link to innovation. For the evolution of content and understanding of themes in open access projects and activities, interviewees identified various different enablers:

- Scientists who know how to carry out research properly;
- CSOs that know what type of inputs are necessary to be effective in policy development (including formal and informal channels to provide information);

- Broad dissemination strategies (in general, scientists are not too keen on this, but civil society involvement helped);
- Personal commitment of main research leaders to using funding for policy impact and not solely for career advancement;
- Framework conditions creating windows of opportunity, like institutional discussion (e.g. in parliament);
- Links to policy networks even at proposal-writing stage that bring together not only scientists but also politicians and other stakeholders.

According to respondents, SxS projects have many advantages contributing to the evolution of content and understanding of themes:

- The projects allow for testing the effectiveness and comparing policies across many countries, involving much larger scales than national research;
- They create opportunities for cooperation and the exchange of views with other stakeholders and other nationalities, giving extraordinary possibilities that can only be achieved through EU programmes;
- SaS/SiS projects give policy making a more professional way to address issues. Often, policy makers do not have sufficient access to expertise nor the right tools and attitudes for evidence-based decision making. By funding SaS and SiS projects, they can broaden their professional scope of engagement addressing thematic areas.
- Most pressing problems and societal challenges cross boundaries. Therefore, collaboration which crosses boundaries of states and disciplines is pivotal to tackle them. EU programmes also have relatively pragmatic regulations for traveling, exchanges, etc.

The interviewees stressed the positive role of SaS and SiS in contributing to national discourses. In many areas, they had a breakthrough role, creating new research agendas. In addition to that, they contributed to the consistency and alignment of policies and research approaches across Europe, particularly for bridging the gap between research and society.

SaS and SiS projects contributed to the international positioning of EU research and created knowledge and epistemic communities. Interviewees observed redundancy in SaS/SiS, which can be interpreted negatively from an economic efficiency perspective, but can have advantages from an epistemic point of view.

In summary, SaS and SiS projects had, according to responses, many advantages contributing to the evolution of content and understanding of themes. They often pioneered, in an exemplary way, the extension of the scientific discourse to some stakeholder groups such as CSOs. Activities in networks of companies or training institutions integrated additional actors which contributed to epistemic communities and new advocacy coalitions. The SaS and SiS projects inspired global scientific and stakeholder communities (e.g. related to global health, the future of energy). The EU funding also allowed young scientists from all over Europe to participate and improved international outreach and dissemination.

The impact of these activities manifested itself in specific projects of the researchers as well as in government and scientific advice projects. Usually, three types of outputs and outcomes were identified:

- Publication of scientific articles;
- Advice for public authorities;

- Capacity-building.

It was found that scientists learned to undertake science communication in a more professional way. Moreover, the sharing of ideas and methods within research consortia contributed to the development of content and understanding of the themes. They built capacity in managing technical infrastructures, understanding the mind set of partners and stakeholders. They also helped in the documentation, comparison and evaluation of (national) research.

However, the exchange of the content and understanding of themes can be too intense for some participants, especially those who participated for the first time in SaS and SiS projects. Even though the content and understanding of themes may have evolved substantially in some SaS and SiS projects, some participants could not cope with that evolution and regressed to their original approach.

Working in SaS and SiS projects added a transnational perspective thanks to the collaboration with people from other regions, different/various disciplinary backgrounds and stakeholder views. SxS projects were seen by interviewees as a learning exercise that provided the opportunity to exchange best practices.

Project managers benefited from the support SaS and SiS provided to improve their organisation skills in term of management (e.g. respect project timeline and FP rules). They expanded their scope from national research questions and networks towards a European and international perspective. Therefore, a high impact can be identified in day-to-day work and strategic decisions. A broad consensus was held amongst participants that SaS and SiS projects often have a long-term impact on the evolution of content and understanding of themes.

4.2.3 Impact of the programmes

How far has the SaS/SiS programme achieved its general objectives? How far has the SaS/SiS programme achieved the objectives of the Science and Society Action Plan?

The programme objectives are defined in very general terms (i.e. boost gender equality). As a result, measuring their achievement in quantitative terms is not possible. As reported by an interviewee, the objectives of the SiS/SiS programmes were defined in such general terms that the programme activities and funding were insufficient to really have an impact on a large scale. It was difficult for interviewees to comment on the achievement of the SaS/SiS programme objectives and most of them agreed that these objectives are still far from being reached. However, this opinion is not due to the failure of these programmes, but to the far-reaching objectives that were defined.

Gender and science. Positive impacts were reported in relation to gender balance in R&I. In this regard, SxS projects positively contributed to raising awareness amongst Member States and influencing public opinion. This was achieved through the creation of networks that are, in some cases, still functioning (i.e. the EPWS network which connects more than 12,000 female researchers) and the publication of gender-sensitive reports (i.e. SHE Figures) that increase general understanding of the current state of gender equality in research and innovation in the European Union. These reports were also taken into consideration by several EC Directorates Generals for their work.

However, although the SHE Figures[79] show an increase in female participation in research fields such as engineering, mathematics and computing (an increase that is much faster than the increase in male participation in research), interviewees could not clearly disentangle the contribution of the SxS programmes from the overall initiatives at EU level. Some interviewed experts in the gender and science dimension were sceptical about the Commission's achievements in supporting the objective of ensuring equal opportunities for male and female scientists and suggested a stronger commitment by the Commission in this field.

Another objective of the Commission on this dimension was to foster the integration of the gender dimension of research in other parts of the Framework Programmes. There is a clear distinction between the gender dimension in research and content (e.g. considering sex/gender as a factor or analytical category in research or in gendered analysis) and gender balance in research teams (i.e. the composition of the personnel primarily responsible for carrying out research activities), where most of the progress has been made so far.

Analysis of the case studies shows that most SxS projects focused on improving gender equality in research teams and a few of them directly addressed the integration of gender analysis in research content. The analysis of the "other" FPs projects shows that only a small share declared to have taken into account gender analysis in research content. This share does not vary from FP6 to FP7. This suggests that the impact of the SxS programmes in fostering the integration of the gender dimension in the content of EU research led by other parts of the FPs was not fully achieved.

Science literacy. Key objectives were to increase public awareness of scientific and technological advances (SaS) and to raise the general level of science literacy (SiS). Analysis of the case studies shows that relevant results were achieved through the organisation of science festivals, science contests and other initiatives to demonstrate the potential application of technologies. Relevant outcomes were achieved also with regards to the objective of promoting young people's interest in science and improving science education. Indeed, innovative teaching tools were tested and disseminated in different Member States and project partners often reported an increased interest in science.

Despite these achievements, a lot remains to be done in this area. As highlighted by an expert, these projects have increased people's interest in science but for the objective of raising awareness amongst scientists of the concerns and interests of citizens much less was achieved.

Science and ethics. Interviews with experts suggested that ethical issues in research have gained heightened importance over the period of this evaluation study. As highlighted in the section "Evaluation at other policy levels", the increased attention paid to ethical issues is confirmed by the increasing number of SxS projects that were subject to ethical review from FP6 to FP7. The programme-level objectives related to ethics evolved over time, becoming increasingly integrated into governance issues. Analysis of the case studies shows that SxS projects contributed to placing ethics at the centre of science governance. The projects mainly contributed to this by raising awareness and

[79] SHE Figures 2012 and 2015.

strengthening capacity to reinforce the role of ethics in the governance of research, and by developing new ethical frameworks.

Governance and scientific advice, RRI. The main objective set at programme level was to strengthen the effectiveness and scientific basis of policy decisions in multi-level governance. Given the nature of this objective, it was particularly difficult to estimate SxS's impact, nor was it possible to collect conclusive opinions through interviews. However, the increased implementation of RRI in Horizon 2020 (that provides a reference framework for all research and innovation activities) demonstrates significant progress towards science-based policy making. Moreover, analysis of the case studies shows very concrete examples of SxS's contribution to increasing the uptake of scientific evidence in policy making and rendering it more effective. Forums and platforms for scientists, policy makers, society, and media experts were created for discussing and analysing lessons learned by research projects.

Civil society and citizen participation. As already indicated, it is hard to isolate the programme objectives for this dimension, given that aspects of civil society and citizen participation are highly integrated within the other dimensions. Bringing together the different aspects of this dimension from the different activities in the WPs, the following objective can be defined: to provide society with the opportunity to influence scientific decision making and participate in the scientific process itself.

The increased participation of CSOs in the research projects funded by the EU through FP6 and FP7 shows that important progress was made towards a stronger participation of society in science. However, satisfactory levels of public engagement are still to be attained. SaS and SiS are the programmes under FP6 and FP7 that proved to have involved CSOs the most.

More generally, SxS projects contributed practically to promoting dialogue between society and research, by performing cooperative research and building networks between local actors that act as intermediaries between the general public and researchers (such as bodies involved in the organisation of science events).

Despite these results, expert opinions were divided about the actual achievement of the programme objectives. Various interviewees agreed on progress in the field of civil society and citizen participation. In particular, through the SxS programmes, non-profit organisations gained visibility. Yet other interviews outlined that civil society's participation was not mainstreamed and should not be taken for granted, and more attention should be paid to ensure that NGOs and CSOs increase their participation in projects.

Open access, open science. The debate about open access gained particular importance starting from 2010. Therefore, the proper objective at programme level was set starting from the FP7 SiS WP 2011. The main objective was to bring science closer to citizens by encouraging debate on information dissemination and improving access to scientific results for the general public. The interviews performed suggested that, overall, significant progress had been made. As one independent expert underlined, nowadays, there is a "… stronger culture of inclusiveness of research in society and access to knowledge does not depend upon the status of the people". SxS projects largely contributed to this achievement. All SxS projects made efforts to ensure open access to their results, by organising open conferences and adopting innovative digital solutions to share results with RRI stakeholders and a global audience.

Regarding the Science and Society Action Plan, it is a shared opinion of the interviewed experts that since its launch significant results were achieved, though the overall top-level objectives have yet to be attained. As outlined by an interviewee, the SaS Action Plan aimed to achieve societal changes that could not be tackled by an EU programme alone. It therefore cannot be expected that the Commission will achieve these objectives by joining efforts just at an EU level, as there is a need for further alignment and uptake by national policy makers. In particular, according to interviewees, significant action had been taken in order to achieve the objective of "*putting responsible science at the heart of policy making*", whilst achievements do not seem to be satisfactory with regards to the objective "*promoting a scientific and education culture in Europe*".

In the survey, 42% of the respondents indicated project activities as having contributed - directly or indirectly - to the actions of the SaS Action Plan. A further evaluation of the case studies demonstrated that all projects contributed to the plan's actions, despite only 14% of the projects making an explicit mention of the plan and provided a description on how the project activities contributed to its objectives.

As reported in Paragraph 4.1.1, the study shows that, out of the 38 Actions of the SaS Action Plan, the five that were most addressed included:

- Action 36: Establish guidelines on the use of expertise;
- Action 20: Organise local and regional dialogues on "Science and Society";
- Action 23: Inaugurate public discussions and hearings on specific themes;
- Action 27: Promote gender equality in science in the wider Europe;
- Action 29: Help set up an information and documentation observatory for ethical issues

What other wider impacts (on stakeholders, on EU policies, on Member State policies) have been generated by the SaS/SiS programme?

Assessing the impact of the programme on stakeholders and policies is extremely complex. There is no strong evidence of the extent of the impact generated by SaS/SiS programmes at European scale. This section builds, to a large extent, on final project reports, evaluations and interviews thus, not all impacts could be identified. Generally, greater attention is paid to the achievements and the advances towards the programme objectives rather than to wider external changes in the surrounding policy, institutional, societal and organisational environment. As pointed out in previous evaluation studies, the main obstacle is the lack of sound evidence against the expected impacts. Difficulties in establishing causal links and the lack of guidance on how to measure such impacts are amongst the factors hindering assessment. However, the case study research shows that a wide range of benefits were generated by the SaS/SiS programmes in relation to different thematic areas. An overview of the main positive impacts is provided below by type.

Policy impacts: The extent of the impacts on decision-making processes varies greatly at different levels by theme and context. Overall, the SaS/SiS programmes had a considerable impact on EU and Member State policies, especially in relation to gender and public participation.

As for the gender dimension, the SaS programme contributed to spreading better understanding of the needs and roles of female scientists amongst policy makers by involving them in networks supporting gender equality and by providing them with new sources of information, expertise and advice from stakeholders. Increased awareness of the relevance of gender issues, influenced national and regional policy agendas and debates, paving the way for structural changes. The BASNET project, for example, developed a regional strategy for women in science and high technology in the Baltic States, which was discussed by national governments and used as a reference for a Resolution on gender equality by the Baltic Assembly. The ADVANCE project, by contrast, had marked impact at national level by introducing mentoring as a new approach for career development in Bulgaria and Poland. In addition to the previous programme, the knowledge and tools developed by the SiS projects stimulated Member State advances in the field of gender equality in science and research. For instance, the recommendations issued by the GENDERA project provided the basis for a policy brief and discussions about gender equality in research policy which improved the national and local situation.

In relation to public participation, the programme applied new forms of public engagement in research activities to set an effective integration model in European research. The engagement of stakeholders, CSOs and public bodies demonstrated that embedding science in society was possible. As underlined in a previous evaluation (European Commission, 2016a, p. 66), the development of Mobilisation and Mutual Learning (MML) Action Plans also favoured a closer interaction between scientists, policy makers and CSOs in key policy areas. Amongst the projects, GAP1 successfully involved stakeholders and scientists in planning cooperative research along with policy officers, thus influencing the EU policy on fisheries and marine research. At national level, the WINDFARMPERCEPTION project carried out a study gathering knowledge on the residents' perception of wind turbines, which led to a review of all wind turbine noise exposure studies by the Dutch government. For some stakeholders, the involvement of a great variety of stakeholders from across Europe was an enabler of policy impacts as it increased the visibility of programme topics and the scale of the debate. A more holistic approach to policy making was likely to be adopted thanks to the multitude of inputs provided.

In the field of science literacy, the programme encouraged the adoption of innovative education techniques (IBSE) through pilot projects and launched many initiatives for promoting science and technology for the young public. A consistent effort was made to influence teaching practices and engage students, education providers and bodies in strengthening the link between science education and careers. The case studies show that some projects were able to deliver results which influenced, to some extent, educational practice on the ground at the national and local level. The ENGINEER project, for instance, designed and implemented IBSE teaching modules regarding engineering in primary education science curricula along with training for teachers. In at least two of the countries involved, the Ministry of Education showed an interest towards the activities of the project: in the Netherlands, it was decided to set science and technology as mandatory part of the science curriculum in primary schools by 2020; in Israel, the Ministry of Education endorsed the project encouraging the introduction of the ENGINEER modules in the Israeli school curricula at the elementary and junior levels. Similarly, the PROFILES project produced and implemented teaching modules for promoting IBSE in schools and non-formal education centres. Teacher training on the PROFILES philosophy enacted a multiplier effect of modules at the local level. Other SaS/SiS projects were successful in defining attractive and innovative methods to engage the younger population on a wider scale. The EUROBOT 2006 project organised an international educational contest in robotics which was included in the framework of the 2006 Europe Science Week. The contest involved 247 participants including people and teachers. It became a milestone for the promotion of scientific knowledge amongst European citizens in general. According to participants, the experience reinforced the interest of young people in scientific careers and of the general public for science. Despite this, however, there is no substantial evidence that science education projects had relevant systemic impacts on national education policies and practices across Europe. Some stakeholders indicated the limited time-frame of projects and the lack of commitment by education authorities as possible obstacles to impacts.

With regards to ethics, the programme investigated the ethical concerns arising from emerging science and technologies taking into account the point of view of different stakeholders, researchers, businesses and citizens. Projects funded under the "science and ethics" dimension often involved key stakeholders and issued recommendations and guidelines on best practices to influence policy and decision makers. In terms of impacts, the research outputs stimulated the ethical debate on emerging science and technology issues including potential risks deriving from applications, and laid down the ground work for publications. The SYNTH-ETHICS project researched ethical and social issues raised by synthetic biology and relevant normative frameworks and issued recommendations concerning safety and security aspects. However, there is no strong evidence regarding the extent to which the programme's outputs and results had an impact on stakeholders or shaped policies and practices. As underlined by previous evaluations (ICF Consulting Services, Delft University, Facts of Life and Technopolis, 2016, p. 107), FP7 SiS contributed to the legal developments in the area of ethics. An important policy impact of the SiS programme was the introduction and formalisation of the ethical review mechanism for all framework research proposals under FP7. Many ethical aspects of research, including the impact on minorities, vulnerable groups, privacy, and dual use were embedded in the Rules for submission (European Commission, 2011). Ethics reviews were also conducted during or after the project duration, promoting a higher ethical awareness amongst participants.

In the field of open access, open science, the SiS programme systematically involved national policy makers and representatives in many activities in order to raise awareness regarding the relevance of open access. Analysis of the case studies does not provide evidence of relevant changes regarding comprehensive open access policies or strategies.

Institutional and organisational Impacts: Overall, the programme had consistent and diverse impacts at the institutional and organisational level across many themes. The main institutional impact was the establishment of bodies, institutions and networks that lived beyond the project lifetime and funding. As a proof of the powerful legacy of the programme, some organisations gained strong research capacities and continued to shape the EU policies in their area of competence.

Regarding gender issues, for instance, the BASNET Forum was established to monitor/support the implementation of the BASNET project strategy for Women in Sciences in the Baltic States region and to disseminate good practices. Today, it is also a member of the EPWS – an international non-profit organisation representing the needs, concerns and interests of more than 12,000 female scientists in Europe and beyond which was established by the PLATWOMSCI project. New bodies were also established in other fields.

Regarding ethics, the RISE project partners formed a new body of the EAB European Association of Biometrics - the EAB Special Committee on Ethical, Social and Privacy aspects of Biometrics - to ensure coordination on important ethical issues.

Some projects setup new networks or contacts for future cooperation in research in different thematic areas and for the diffusion of scientific culture (e.g. INWES, PIER, ESOF2010, ESOF2012, SERSCIDA) while others reactivated already existing and latent networks thanks to the knowledge and experience gained through SaS/SiS activities (e.g. FUND, RESPONSIBILITY, WONDERS). A shared commitment towards the SaS/SiS priorities has originated from the newly formed networks.

Changes in the internal organisation and working practices of participants were expected as a result of the programme activities, especially related to public participation in science research and ethics. Specifically, the knowledge of the benefits of involving CSOs in science was expected to promote participatory research processes in many fields. Limited evidence was found in terms of long-term impacts at European scale.

An enhanced research capacity in terms of SaS/SiS priorities derived from the programme activities which provided new models and structures. The MIDIR project, for instance, delivered a risk governance framework serving as a new comprehensive model for assessing and dealing with risk and uncertainty in policy making.

Lastly, the programme raised general awareness of issues relating to gender, science education, and debates in ethics amongst participating organisations. In some cases, a better understanding of societal needs was key for participants to start similar initiatives/projects within their own institutions (e.g. career mentoring programmes after the ADVANCE project). Apart from the new institutional settings, participating organisations often continued the informal networking established during programme conferences and events to exchange good/best practices, foster cross-national cooperation, and build partnerships with relevant stakeholders at the national and regional level.

Social media impacts: Overall, the programme had limited impacts on social media in terms of magnitude of conversations generated around SaS/SiS issues. The social media analysis shows that many projects had zero or close to zero mentions in related posts during the observation period. Around 32 projects selected within the social media analysis reported slightly higher rates and a minority reached more than 50 posts (for example RISE, DIALREL, FEMCIT).

The extent of the impact on social media was not affected by the thematic dimension of the project and the analysis revealed large differences between initiatives in the same field. In the gender dimension, for instance, the WOMEN-CORE project had no social media impact while PLATWOMSCI reached 29 posts over the observation period. Neither the total amount of funding, nor the geographical coverage of the project seem to have directly influenced the extent of the social media echo.

The main factor explaining “social media performance” was the state of technology at the time, along with the nature of the project. The concept of social media was not widely developed during FP6, as information and communication mainly relied on traditional means. Under FP7, technological advances and their spread made permitted a more widespread use of social media as tools to interact and inform people. Evidence of this evolution is provided through the EuroScience Open Forum (ESOF) Conference series organised to promote Europe-wide scientific achievements. The first conference (ESOF 2006) had modest impacts on social media, as just 18 posts were identified. In the following two events - ESOF 2010 and 2012 - a more consistent use of social media was assessed, but with some differences in relation to Twitter (816 tweets on ESOF 2010 and 18,093 tweets on ESOF 2012). Facebook, web fora and blog posts were used to communicate about ESOF with the largest share of posts reached in the respective host country. The social media analysis also shows that the number of posts quickly decreased in the aftermath of the two ESOF conferences. Thus, the social impact usually remains mostly limited to the time of the event.

Scientific impacts: The scientific impact of both programmes defined as the number of scientific publications is limited. Regardless of the type of document (i.e. scientific articles, conference proceedings and books or book chapters) and the time of publishing (before, during or after the FP support), there are differences between the two programmes. The average number of scientific publications per project is higher in SiS than in SaS projects within all the dimensions considered (1.05 for SiS and 0.9 for SaS).

There are potentially many factors explaining the scientific performance of SaS/SiS programmes. The *attractiveness* of the participating institutions as defined by the Leiden ranking, may represent one cause of the different scientific outputs. In fact, the analysis of data gathered on SaS/SiS projects shows that:

- The positioning in the Leiden ranking does not affect the number, nor the quality of scientific publications;
- There is a general positive correspondence between the number of participating universities in the project consortium and the number of scientific publications related to the project. However, this result is valid only for SiS projects. Indeed, SiS projects involving more than two universities, also have above-average scientific publications;
- There is no link between the consortium composition and the number of citations of published documents. This means that a higher number of participating universities in the consortium does not necessarily lead to higher quality in scientific outputs.
- In general, it has to be underlined that scientific impact is not to be considered as a core expected impact of projects funded under SxS programmes. Thus, the limited impact reached by the programmes in this area should not be considered negatively.

Did the programme generate organisational research capacity in terms of SaS/SiS priorities? Is this capacity sustainable? Did the programmes generate Human Research Capacity with SaS/SiS skills? Did the programme increase gender equality in Human Research Capacity? Is this capacity employable in the medium term?

Two premises are necessary to contextualise the assessment that follows. First, SaS demonstrated clear oversubscription due to the limited budget. SaS projects were substantially smaller in budget and the number of participants compared to their benchmark samples. This, however, changed with SiS where projects were, on average, five times larger than in SaS with the average number of participants in a consortium being 50% larger than in SaS. SiS projects tended to have a similar size to their benchmark projects in other parts of FP7. According to the ex-post evaluation of the SiS programme by ICF "*The projects also suffer from the problems of project-based approaches and* *standard funding rules and timeframes. Projects inevitably follow the idea '-> team -> project -> report -> dissemination cycle and (2-3-year) timeframe'. It is very difficult to effect widespread change within this limited framework*" (ICF Consulting Services, Delft University, Facts of Life and Technopolis, 2016, p.102). Second, SxS projects have involved a more diversified range of stakeholders, and particularly CSOs and the participation of such stakeholders in SxS and "SxS-related" projects is larger than in "other" FP6 and FP7 projects. Therefore, project size increased from SaS to SiS achieving the goal of a more diversified participation especially in relation to CSOs.

According to the experts interviewed, SxS projects produced four types of benefits for participating organisations.

- **Human capital**. Improved horizontal competencies, managerial skills, communication skills, and ability to conduct research in cross-cultural environments. Moreover, participation in SxS projects supported research on specific topics generating new knowledge and expertise.
- **Networking opportunities**. These were especially beneficial for small emerging organisations.
- **Organisational capability**. Access to funding allowed organisations to conduct research which was impossible to conduct without funding, and enabled them to achieve more visibility in the community of researchers.
- **Organisational practices**. In some cases, participating organisations also improved their internal gender equality policies and tackled ethical issues that otherwise they would have not considered.

The respondents to the survey of coordinators and participants indicated that participation in SxS projects generated new knowledge (61%), new SxS-specific skills later used in their organisations (41%), and new capabilities (50%). Among the specific skills, many mentioned communication skills and better approaches to stakeholder and project management. The strengthening of existing partnerships (53%) and creation of new networks (57%) were also mentioned.

The picture emerging from the case studies is somehow less positive than what emerges from interviews and the survey. The organisational and institutional impacts reported (or not reported) were clustered as follows:

- No impact;
- **Network** (formal or informal networks established and continuing after the projects);
- **Tools** (i.e. measurement frameworks, guidelines, material, etc. that can be allegedly re-used or have been used by practitioners after the project ended);
- **Persistence** (i.e. where the project persisted in some forms such as through establishing a new organisation, new funding raised, new projects, community still active and using tools, etc.)

In 44.3% of cases, there were no organisational and institutional impacts: 32 projects created new networks (27.8%), in 21 cases (18.3%) there were allegedly reusable or reused outputs, and in only 11 cases there is a real enduring and more tangible organisational and/or institutional impact (9.6%).

63% of the "FP7-related" projects had no organisational impact, a share much higher than for SaS (31.6%) and "FP6-related" (35.7%) projects; the share of projects with no impact is also fairly high for SiS projects (54.5%). Persistence is most widespread for SaS projects (of 11 cases with persistence of impact six concern SaS projects) and tools for "FP6 related" projects. This information, however, should be considered with caution due to the lag time needed to observe impacts (SiS and "FP7 related" are more recent).

The share of PhD holders in SxS and "SxS related" projects is particularly high – around 60% of the team members. Looking at projects per dimension, it is worth noting that there is higher involvement of PhD holders in the "gender and science" and "science and ethics" projects. The share of PhD holders in SxS and "SxS-related" projects is higher compared to other FP6 and FP7 projects.

On average, SxS project teams were composed of a high share of experts in the fields of Humanities and Social Sciences. This share increased from SaS to SiS (rising from about 50% to 65%). This expertise is certainly relevant to SxS, however, a higher share of members from applied sciences, health sciences, and natural sciences would be desirable for cross-fertilisation.

The gender dimension of teams is a distinctive feature of SxS and "SxS-related" projects. The share of women in teams is above 50% in the SaS and SiS projects, and close to 50% in the "SxS related" projects, while it is much lower in "other" FPs projects. As expected, the gender composition of teams varies considerably across the dimensions analysed, with the highest share of women in "gender and science" (89.3% in SaS, 78.6% in SiS), and a more balanced mix in "civil society and citizen participation", "open access, open science", and "science literacy". On the contrary, in SaS and "FP6-related" projects women had a low representation in "governance and scientific advice", which was partially addressed in SiS and "FP7-related" projects. Overall, the percentage of women was higher in SaS (56.5%) than in SiS (50%), as well as in "FP6-related" (46.9%) compared to FP7 "related" (44%). In SiS, the focus moved from female scientists and how their role and image could be strengthened to the institutions that employ them, to encourage them to change their working environment and culture to better support gender diversity. 29% of the respondents to the survey of participants and projects coordinators reported that their involvement in an SxS project improved the internal gender balance. 25% claimed that their participation led to an internal organisational change which led to the creation of specific departments dedicated to research in science/society topics.

Another way to indirectly examine these issues is by looking at the ex-ante impact analysis with respect to three indicators: a) network centrality; b) attractiveness to top scientific institutions; c) attractiveness to R&D oriented businesses. Projects involving network pivotal organisations, top scientific institutions, and R&D oriented businesses would have clear spill over effects in terms of human capital and various capacities. The main findings are summarised below:

- **Network centrality of project participants**. The network centrality of SaS projects is significantly lower compared to the benchmark samples; the same conclusion applies to SiS and to "SxS related" projects;
- **Project attractiveness to scientific institutions**. Again, the picture is similar to that of network centrality. SaS projects seem to be less effective than "other" FP6 projects in attracting the most excellent universities, independently from the content of the project. However, this gap is filled in FP7, where SiS projects are attractive as much as any other FP7 projects;

- **Project attractiveness to R&D-oriented business**. Results show that SxS themes are attracting fewer top R&D firms than "other" FP projects.

In conclusion:

- The interviews with experts and the results of the survey support a general positive assessment based on which SxS projects have generated capacities in all dimensions;
- Statistics on gender composition of the teams and survey findings suggest that SxS projects have contributed to more gender balance in human research capacity, and certainly much more than "other" FPs projects. Indeed, by increasing gender diversity in research teams, SxS projects ensured a plurality of talent, perspectives and insights that is essential for a higher human research capacity in terms of scientific quality and societal relevance of produced knowledge. As reported in the PLATWOMSCI final report, the participation of women in science and research is essential to achieving excellence and innovation in research and to ensure a sustainable scientific quality of research. The case study confirmed that the platform established by the project - 'EPWS' - consisting of female scientists of all disciplines and policy makers in Europe, contributed to increasing the participation of women in EU research and delivered high-quality position papers. In addition, as specified in the "ex-post evaluation of science in society in FP7" (ICF Consulting Services, Delft University, Facts of Life and Technopolis, 2016), the DIVERSITY project demonstrated that gender diversity fosters science excellence and improves European research and innovation systems. Finally, one interviewed project coordinator stressed that "SaS and SiS projects contributed significantly to the creation of specific human research capacity of participating organisations in terms of increased gender equality and new knowledge";
- This positive assessment should be, however, mediated by the more modest results in terms of organisational and institutional impacts that emerge from the analysis of the case studies;
- Finally, also the analysis of network centrality, capacity to attract top scientific institutions and R&D oriented businesses shows modest results, even though the capacity to attract scientific institutions increased in the SiS projects.

4.2.4 Tools and approaches used

Have certain types of funding instruments, tools, frameworks, actions, or activity lines proved to be particularly successful or effective with regard to realising SaS/SiS programme objective? What lessons can be drawn with regard to the implementation of Science with and for Society in Horizon 2020? (tools and approaches)

The survey and the interviews asked respondents to assess funding instrument appropriateness with respect to: a) focus on the objectives of the project; b) perform the work undertaken; c) creation of the right partnerships/consortia; d) right engagement of the stakeholders. The instruments assessed were "Collaborative Projects" (CP) and "Coordination and Support Actions" (CSA) of the SiS programme and "Coordination Actions" (CA) and "Specific Support Actions" (SSA) of the SaS programme. In general, the overall assessment is very positive in terms of supporting the project to focus on its objectives (84% of the respondents gave a positive assessment) and supporting the project activities (81%); the positive assessment slightly decreases in relation to the creation of the right partnerships (71%) and for the activities requiring stakeholder involvement (65%). More in detail:

- SaS-Coordination actions (CA): on average this instrument was not assessed positively and many stakeholders considered that tools introduced in SiS were more appropriate;
- SaS-Specific Support Actions (SSA): overall project coordinators and participants considered SSA as being a good funding instrument, although a minority of respondents criticised it with respect to the creation of the right partnerships (33%) or the engagement of stakeholders (36%);
- SiS-Collaborative project funding (CP): all survey respondents of projects funded under the CP funding agreed that this funding tool was appropriate for the kind of project, its objectives and focus. However, a large share of respondents (45%) considered this tool as being inappropriate to allow for a good engagement of relevant stakeholders. 36% of the respondents considered the CP funding as being "moderately" appropriate for the creation of the right partnerships;
- SiS-Coordination and support action (CSA): 85% of the survey respondents considered the CSA as being appropriate for the type of objectives and focus of the project. Amongst the respondents to the survey, comments received agreed on the fact that CSA funding facilitated the participation of appropriate partners and gave possibilities to cover those costs that organisations usually cannot bear. A small share (14%) considered this tool as being not very appropriate. In addition, the size of the project consortia involving partners from different Member States may have an impact on the quality of research as significant effort in project management activities is needed.

An instrument worth mentioning separately is the Mobilisation and Mutual Learning (MML) actions, a programming instrument introduced in 2010 to increase project scale and the diversification of partnerships. In total, 18 MMLs were funded under SiS (10% of the SiS portfolio). In comparison with non-MMLs SiS project, this new tool funded projects that: a) were much larger in terms of average project costs; b) were much larger in terms of the EU's financial contribution; c) involved much larger consortia; d) involved a greater percentage of organisations with very limited or no experience of the Framework Programmes (ICF Consulting Services, Delft University, Facts of Life and Technopolis, 2016, p. 139).

An analysis of 60 SaS and SiS case studies covering several dimensions of impact was performed *ad hoc* for this final report. Project were scored over six dimensions: 1. Impact sustainability; 2. Policy impact; 3. Scientific impact; 4. Impact on stakeholder engagement; 5. Innovation impact; 6. Impact in terms of links with other projects. These six scores were then used to produce a composite index expressed in percentage through which the cases were ranked.

The main highlights from the aggregate ranking exercise are as follows:

- SaS projects are more numerous than SiS projects amongst the top ten ranked projects;
- All projects, both SaS and SiS, score relatively low in terms of policy and innovation impacts;

- No clear discernible patterns emerge in the ranking in terms of dimension: at least one project for each dimension can be found in the top ten cases; however, it seems that the "science literacy" score is higher when assessed against the other dimensions.

The aggregate score was then used in each dimension to assess whether some action lines, activities, and thematic areas scored better than others. The main findings are as follows.

Gender and science. The top scoring projects are under SaS activity 4.3.5 Women and Science. The thematic area 4.3.5.1 ranks in the first two positions.

Civil society and citizen participation. SiS projects tend to be ranked higher than SaS projects, but no clear pattern emerges to differentiate action lines, activities, and thematic areas.

Governance and scientific advice. SiS projects tend to score higher than SaS projects, but no clear pattern emerges to differentiate action lines, activities, and thematic areas.

Open access, open science. Due to the limited number of cases (two in SiS and two in SaS), the ranking in general and with regards to activities and thematic areas does not provide relevant information.

Science and ethics. SiS projects tend to score higher than SaS projects. Action line 5.1 (A more dynamic governance of the science and society relationship) reaches the highest score.

Science literacy: SaS projects score higher than SiS projects, but no clear pattern emerges to differentiate action lines, activities, and thematic areas.

The composite multidimensional score was also used to rank the funding instruments for the 60 SxS cases. In this case SSA (for SaS) and CSA (for SiS) are by far the top-ranked instruments followed by CA, STREP, and particularly CP.

Another way to look at the different funding instruments is to compare them in terms of organisational and institutional impacts. The analysis of the case studies shows that SSA accounted for 63.6% of the projects showing persistent impact. Collaborative Projects (CP) account for the highest share of projects reporting no organisational and institutional impacts.

In conclusion:

- It can be safely stated that SSA and CSA are the funding instruments that proved to be most successful;
- With respect to action lines, activities, and thematic areas by dimension, no clear patterns emerge, with the exception of projects in SaS Gender and Society thematic area 4.3.5.1 (Stimulating the policy debate at national and regional level and mobilisation of female scientists) and SiS Science and Ethics projects in action line 5.1 (A more dynamic governance of the science and society relationship).

As for **the lessons for the implementation of Science with and for Society in Horizon 2020,** there is a **direct correlation between SaS/SiS and SwafS.** Five out of the eight headlines of the SwafS programme come from the predecessors (i.e. gender equality, integration of citizen interests and values in research and innovation, formal and informal science education, accessibility and use of research results, governance for the advancement of responsible research and innovation and the promotion of an ethics framework for research and innovation). The remaining three headlines (i.e. attractiveness of scientific careers, anticipation of potential environmental, health and safety impacts, and improved knowledge on science communication) were initially included in the Science and Society Action Plan but were left behind as they were not considered as priorities at the time. The SiS programme evolved over time in response to new developments and lessons learned, with two major programming developments: (i) the shift towards the RRI concept, and (ii) the introduction of MMLs in 2010. In particular, as highlighted in the ICF Final Report (2016, pp. 140-141), SiS was effective in mainstreaming SiS/RRI aspects within H2020. Specifically:

- RRI and gender were incorporated as cross-cutting issues within H2020;
- The rules of participation in H2020 include an explicit requirement for ethical reviews of proposals submitted under the research programme;
- Article 40 of Regulation 1290/2013 mandates to address calls for applications to CSO representatives.

The move towards SwafS in H2020 brought **some relevant changes** to the SxS programmes with some dimensions that changed significantly in content (for instance “science literacy”) and others (for instance “gender and science”) that remained more stable. In parallel, the institutional reorganisation of the EC that centralised in a single Unit the coordination of the SwafS and RRI responsibilities, previously spread across several units, reflects the intention of the EC to set a common and unique framework for SxS and RRI dimensions. This should allow an effective coordination of the programme and a guidance to the mainstreaming of the RRI dimensions in other EU and national policies and initiatives.

The impact of SaS/SiS programmes on developing the RRI concept was highlighted by several stakeholders. Introduced towards the end of FP7, it is now perceived as a key objective of the Commission for H2020. The first generation of SaS/SiS projects contributed to developing and refining this concept.

The lessons learned with respect to the implementation of SaS and SiS can be summarised as follows:

- The fragmentation of activities and the lack of a clear focus partially hampered the potential impact of SxS project and should be avoided;
- More emphasis on project impact beyond their own boundaries should be introduced;
- New entrants should be provided with more help to make their access to funding easier, and this is particularly relevant to CSOs and SMEs;
- As for many other parts of the FP7, most participants to SxS project unanimously request lighter administrative and reporting requirements and more flexibility in adjusting work plans and consortium creation and changes.

In summary, in terms of evolution and lessons learned from SxS towards Horizon 2020 SwafS, there are two key conclusions: a) both SaS and, particularly, SiS were successful in shaping SwafS and there is a clear line of continuity; b) less fragmentation of activities and more flexibility in programming may improve the new Horizon2020 programme dedicated to SxS topics.

Are there noticeable changes in project funding and budget to achieve similar objectives going from the beginning of FP6 to the end of FP7?

The results of the composition analysis show that the median funding per participating organisation tripled from SaS to SiS. More in detail, the average funding per participant has significantly increased in "civil society and citizen participation", "science literacy", and, to a lesser extent, in "science and ethics" projects.

Funding across the SaS and SiS Action Lines varied considerably and influenced the number of financed projects. Under the SaS programme, for example, most projects (63%) were funded under the "Stepping up the Science/Society" action line, followed by "Responsible research and application of science and technology" (23% of the SaS projects) and "Bringing research closer to society" (13% of the SaS projects). The distribution of the funding across the Action lines was slightly more even under the SiS programme. The Action line "A more dynamic governance of the science and society relationship" included 50% of all the projects while 32% of them were funded under the "Strengthening potential, broadening horizons" action line and 15% under the "Science and society communicate" action line. The remaining 3% of the projects were funded for the "Strategic activities".

By looking at the distribution of the funding per dimension – considering that each RRI dimension comprises similar/related programme objectives – "science literacy" was the most funded dimension with over €128 million. The EC contribution on these projects nearly tripled in the SiS programme reaching €95 million and topping the ranking of the most funded dimensions.

Regarding the other dimensions, although the number of "gender and science" projects decreased under the SiS programme in comparison to SaS, this dimension was the second most funded in both programmes with more than €50 million. The size of the budget allocated to projects related to "Science and Ethics" did not change considerably between SaS and SiS. However, while under the SaS programme this dimension was the second most funded, under the SiS programme it received the second lowest total funding.

The overall budget allocated to the SiS programme was considerably higher in comparison to its previous edition and nearly all dimensions benefited from receiving larger amounts. However, due to the increasing importance of the RRI policy and the new strategy of the Commission to foster the participation of civil society in research and communication activities, the SiS programme registered a considerable increase in both the "governance and scientific advice" and the "civil society and citizen participation" budgets (the first increased by 10, the second by 5.5).

Table 14 below reports the overall EC contribution to SaS and SiS projects by dimension.

Table 14 - EC Contribution by dimension

Rank	Dimension	Total SxS budget	SaS Budget	SiS Budget	Change
1	Science Literacy	€128.4 m	€33.1 m	€95.2 m	▲ (2.8x)
2	Gender and Science	€50.1 m	€16.6 m	€33.5 m	▲ (2x)
3	Science and Ethics	€37.5 m	€19.1 m	€18.4 m	= (1x)
4	Civil Society and Citizen Participation	€32.1 m	€4.9 m	€27.2 m	▲ (5.5x)
5	Governance and Scientific Advice	€31.2 m	€2.8 m	€28.4 m	▲ (10x)
6	Open Access, Open Science	€13 m	NA	€13 m	New

Source: Authors' elaboration based on eCorda data (January 2017)

4.3 Evaluation at other policy levels

4.3.1 SaS - SiS programmes and the EU Framework Programmes for R&I

4.3.1.1 Coverage of SaS-SiS aspects in FP6 and FP7

What is the extent of SaS/SiS aspects being embedded horizontally in FP6/FP7 programmes and activities? Did the embedding of SaS/SiS activities in the content of research evolve (increase, decrease, etc.) in and between FP6 and FP7?

A common view of interviewed stakeholders is that an increase in the cross-programme integration is visible going from FP6 to FP7. This is especially due to the implementation of the RRI policy, which in 2010 embedded the different dimensions of SaS/SiS programmes in EU funded research projects. Such integration is considered to be even more visible under Horizon 2020. However, although the RRI policy supported the awareness of the science/society dimensions, most respondents consider these aspects as being mostly collateral to the projects and not as central as they might be under the SaS/SiS programmes.

Gender and science. Some interviewees expressed concerns about the horizontal integration of the gender dimension under the FP7 programme. There are two aspects of gender issues in FP projects: the first refers to organisational aspects in the composition of research teams; the second refers to the integration of gender analysis in research content ("fix the knowledge"). The analysis of monitoring reports of the sample of "other" projects' regarding the implementation of Gender Equality Actions and the relevance of the gender issues in the research content, shows that:

- Under FP6, around 36% of the "other" projects did implement Gender Equality Actions and around 18% of them included gender analysis in their research;
- the share of FP7 "other" projects that have implemented Gender Equality Actions is around 23% (with peaks of around 31% - 40% in projects relating to Health, Socio-economic Sciences and Humanities, Nanosciences, Food, Agriculture and Biotechnology). In addition, the

share of FP-7 "other projects" reporting to have a gender dimension associated with the research content was around 12%.

These figures suggest that, going from the FP6 to the FP7 programme, non-SiS projects tackling gender issues decreased. As reported by an expert, in most cases gender aspects in the content of research are considered as marginal to the core project due to the lack of internal expertise in these themes. Nevertheless, most of the interviewees consider the Commission's horizontal approach to be extremely positive since it gives greater visibility to the gender aspects and makes it possible to tackle them differently in each programme. Thus, it should be pursued with greater effort.

Science literacy. In the monitoring reports coordinators were asked whether their projects involved working with students (i.e. organisation of scientific contests, summer schools, conferences targeting students, open days, etc.) and produced any science educational material. Figures related to these activities can be considered as a good proxy to measure the integration of the science literacy dimension beyond the SaS and SiS programmes.

Specifically, as reported by the ICF evaluation of the SiS programme, under the FP7, 36% of the projects included activities targeting students and 37% produced some educational material. The same analysis on our sample shows that under the FP6 programme, just a small share (11%) of the "other" projects did foresee an engagement of students (12% for the SxS related projects).

Science and ethics. Interviewees reported that ethical issues in research have gained importance under the FP7 more than in the past. The analysis of the topics of programmes under the "*Strengthening the ERA*" and "*Cooperation*" specific programmes confirms this: while under FP6, ethical concerns were limited to "the ethical implications […] of developments in genomics research", in FP7 a larger range of ethical issues were raised in projects, including: (i) aspects concerning the militarisation of data or its use by private companies; (ii) the issue of space pollution under the Space programme; (iii) the ethical concerns in research involving human beings, human embryonic stem cells, biological materials and animals in the Health programme; (iv) Nanomedicine under the NMP programme; (v) privacy concerns under the ICT programme; and (vi) ethical implications of advanced surveillance technologies under the SEC programme.

The greater attention to ethical issues is also confirmed when comparing the number of FP6 and FP7 projects that were subject to ethical reviews:

- In our sample of FP6 projects, only 4% undertook an ethical review while the share increases to 16% in FP7;
- Selecting only FP "SxS related" projects, the analysis shows a significant increase, with 9% of the "SaS related" projects and 21% of the "SiS related" projects having undertaken an ethical review.
- In its evaluation of the SiS programme, the ICF reports that in total, only 11% of the FP7 projects had gone through an ethical review (ICF Consulting Services, Delft University, Facts of Life and Technopolis, 2016).

Civil society and citizen participation. More engagement of societal actors was sought in both Framework Programmes. Under the FP6, the specific programme "Strengthening the ERA" included activities aimed at increasing the role of CSOs and citizen's involvement in European policy making. The trend did not change under FP7 where, for example, the Socio-Economic

Sciences and the Humanities theme supported an effective, democratic and innovative governance at all levels while some activities were specifically oriented at fostering the role of civil society and the public-private cooperation to enhance citizen's participation and ownership.

- The analysis of the monitoring reports of the samples of non SxS projects, shows that the share of projects that engaged societal actors beyond the research community increased considerably going from FP6 to FP7.
- More in detail, nearly 25% of the "other" FP6 projects, and 39% of the "SxS related" projects engaged societal actors, while 51% of the FP7 projects engaged societal actors. However, in most cases they were involved in dissemination activities rather than in the implementation of research and the definition of the research content. In our sample of FP7 "SiS-related" projects, the share of projects involving CSOs in the definition of the research content is 18%, while the share of projects involving CSOs to implement research activities increases to 33%.

4.3.1.2 Impacts of FP6 and FP7 projects achieving SaS-SiS objectives

Do vertical and horizontal projects differ significantly with regard to the range and degree of their impacts (on policy, stakeholders, etc.)?

According to the EC officials and interviewed experts, the cross-integration between vertical and horizontal projects became more visible moving from FP6 to FP7, particularly after the introduction of RRI in 2010.

The analysis of the case studies in terms of impact sustainability, policy impact, scientific impact, stakeholder engagement innovation, and links with other policies, shows that, on average, the SxS projects score better than "SxS-related" projects. Both "SaS-related" and "SiS-related" projects show a higher share with no impact compared to SaS and SiS and a very low share of projects with persistent impacts.

In particular, SxS projects scored better than "SxS-related" projects in terms of impact sustainability: several projects were able to create lasting networks amongst participants and provided an opportunity for participating stakeholders to internally develop skills and organisational research capacities (refer to section 4.2.3 for further insights on the impact of the programmes).

In terms of policy impact, analysis of the final monitoring reports shows that 94% of the SiS projects and 84% of the SaS projects produced some policy advice (not necessarily as a main objective of the project). Those percentages are slightly lower but very similar to the outputs of "SxS-related" projects (100% of the 32 selected "SaS-related" projects and 97% of the 32 selected "SiS-related" projects), indicating that a large majority of the projects with SaS-SiS objectives aim at having a policy impact. However, evidence of their uptake by local/national/international policy makers remains limited. In few cases was it possible to find evidence of impacts at policy level for both SxS and "SxS-related" projects. At the same time, the analysis performed on EP questioning (see section 3.2) shows that SxS dimensions were included in 4% of the EP questions relating to science.

In terms of scientific impact, the bibliometric analysis shows that, on average, "SxS-related" projects score better in terms of both the average number of publications per project and the average number of citations. The reason for this result is that the large majority of projects outside the SxS programmes are focused on research activities, which is not necessarily the focus of all SaS and

SiS projects. The presence of SxS objectives in a project seems to lead to lower scientific relevance: even if "SxS-related" projects on average produce more publications, "other" FPs projects, on average, have a much stronger scientific impact.

In terms of stakeholder engagement, innovation, and ability to create links with other parts of the Framework Programmes, no significant differences emerge between SxS and "SxS-related" projects, whereas there are differences in comparison with "other" FP projects. When looking at engagement in terms of involvement of CSOs in the consortia, Figure 10 shows that projects with SxS objectives more frequently include these types of organisations in comparison to "other" FPs projects, especially under FP7.

In conclusion, as reported by some experts, the SxS objectives were not particularly common under other programmes of the FPs. However, when a project treated similar objectives as the SxS projects, its achievements in terms of institutional and policy impact were not as good as in the SxS programme.

How did projects where SaS/SiS was implemented differ from otherwise comparable projects in achieving their stated objectives?

The survey conducted on project participants provides an extremely positive view about the achievement of the objectives. Nearly all the respondents for SxS projects (90%) consider having achieved more than half of the objectives described in their initial proposals. This view is also valid for nearly all participants of "SxS-related" projects (98%). Opinions differ when considering the extent of the achievement of the stated objectives. Approximately half of the respondents from "SxS-related" projects (57%) declare having fully achieved all the objectives, while in SxS projects the share is slightly lower (41%). Apart from the structural differences between the projects, this result can be affected by multiple factors including the timing of the survey. It should be noticed, for instance, that some projects were not closed at the time of the survey and thus, individual perceptions of the projects effectiveness could be different in such cases. However, very few respondents from SxS (9%) and "SxS related" projects (2%) provide negative feedback reporting a "medium" or "low achievement".

According to SxS respondents, the main issues hindering the achievement of the project objectives were mainly operational and related to the implementation phase. Amongst the others, the most relevant problems included: the lack of sufficient time and resources; the lack of commitment from stakeholders and/or consortium partners; the absence of managerial skills to cope with the projects requirements.

Assessment of the case studies integrates the analysis of the responses to the survey. The study has already confirmed the high effectiveness of projects in achieving their specific objectives. The analysis of the case studies shows that the majority of the "SxS-related" projects (around 81%) achieved the expected objectives. A small proportion of them also achieved long-lasting results going beyond the initial expectations. The FOODLINKS project, for instance, developed web-based knowledge exchange platforms which were used not just by participants, but also by stakeholders and experts. The QUING project, by contrast, consolidated knowledge of gender+ equality policies and practices, and further developed related concepts. The percentage of successful SxS-related projects is similar to the SxS projects (82%).

In approximately 11% of "SxS-related" case studies, it was difficult to assess achievement of the objectives. The percentage is lower than for SxS projects (30%), but still meaningful for this evaluation. In some cases, it was not possible to assess the achieved results due to the lack of the project final reports (as in the case of NANODIODE, RESPECT, SECUREPART, VISION RD4SD). In other cases, the problem mainly related to the fact that the project was still on-going at the time of the Case Study (as in the case of FAMILIESANDSOCIETIES, SI-DRIVE).

Some case studies reported significant obstacles which hindered the achievement of the expected results. The CPN-YAS-PRD project, for instance, reported difficulties in recruiting and maintaining partners as local contact points. In some cases, the workload resulting from the literature review or document research was deemed critical to ensuring timely delivery of a project's results (as in the case of PEGASUS, RTD4EDC). Certain problems were similar to those reported in the SxS case studies as they mainly related to organisation and project implementation. Notably:

- Problems in communicating with other consortium members due to the high number of participants and different technical backgrounds leading to delays in reporting (for example CHANNEL);
- Narrow financial and knowledge resources (for example PEGASUS);
- Lack of commitment from project partners generating problems in coordination and data collection (for example LOCOMOTIVE, CPN-YAS-PRD).

Do projects that aim to meet SaS/SiS objectives, both vertical and horizontal, differ significantly from projects where SiS is not integrated both with regard to achieving their stated objectives and with regard to the range and degree of their impacts?

Comparing projects dealing with science/society issues with other projects within the same FPs is extremely complex. Firstly, differences in project structures and instruments strictly depend on the specific programme and action. Secondly, the objectives pursued and the expected impacts of each project vary significantly according to the specific challenges addressed. Thirdly, the implementation strategy and the activities carried out derive from the needs to respond and target the public. Thus, many factors co-determine the outcomes and impacts. However, some general considerations can be drawn. Data collected at project level show that projects funded during the same timeframe, but under different programmes, reported a different performance with regards to their achievements and wider impacts.

All projects aiming to strengthen the link between science and society across the different thematic dimensions were requested, in both FP6 and FP7, to make significant efforts to disseminate their activities and results. Dissemination strategies and means were conceived as strategic for easing the circulation of sound information and knowledge to the public and to policy makers and to inspire critical thinking and better policy making. Interestingly, the analysis shows that the efforts made in disseminating project results through events (such as workshops, conferences, and oral presentations to the public) was greater for projects funded outside the science/society area, than the SiS ones. More specifically, some projects reported more than 100 dissemination events/presentations reaching the peak of 800 in one case (i.e. HERMIONE). A possible explanation is that not all the SiS projects analysed for the scope of this evaluation, systematically reported the dissemination activities in their final reporting questionnaire. Thus, few projects from the sample had above average scores (for example GENDERA, HULDA). Furthermore, it should be highlighted that the objectives stated by projects not related to SaS SiS were specific to their areas of competence and targeted audiences and thus, communicating specific results to selected stakeholders was probably easier than to the general public. SiS projects, instead, tried to contribute to a science-literate society by disseminating information on science and technological advances and contents to the widest possible public audience. However, the analysed projects showed similar average results (around 15 items per project) on media (e.g. interviews, press releases, media briefings). Clearly, the role of the media for disseminating information was massively exploited only in recent years and its use strictly depends on the suitability of project content for the media format. Thus, the modest records by all the projects could be explained by the low suitability of their content to this new language. For the sake of effectiveness, communication with the media should be improved in both cases to attain relevant results. In general, the lack of sound evidence on the previous considerations does not allow decisive conclusions to be drawn on the interpretation of different dissemination results in the projects under study.

A successful dissemination strategy usually results in greater visibility and perceived relevance of project issues and achievements by stakeholders, policy makers and wider society. In turn, the interest generated by the dissemination activities can provide the basis for other scientific publications relating to the discussed topics. Therefore, it is interesting to look at the scientific impact - intended as the number of scientific publications - achieved by projects within different programmes to identify the main differences. The analysis conducted for this section focuses on the scientific impacts of SxS projects, "SxS-related" projects and "other" FP7 projects. This study has already highlighted the differences between the scientific performance of SaS and SiS projects at programme level. The analysis shows that for "SaS-related" projects, the average number of publications per project (1.7) is higher than in SaS (0.9). Similar results are found by comparing "SiS-related" projects with SiS projects (2.1 against 1.05). Furthermore, the FP7 Cooperation programme, which funded many "SiS-related" projects as well as "other" projects, reports on average 11 publications per project. The scores for SxS projects are systematically lower when assessed against projects funded within the same FP but under different programmes. Regardless of the thematic dimension, it is possible to observe that the "scientific performance" of projects improves with the progressive dilution of the SaS-SiS topics. This means that projects not pursuing SaS-SiS objectives usually have more publications. Thus, the very nature of the SxS projects probably determines a lower interest by the scientific community in issuing publications.

In some cases, EU-funded projects delivered outputs and knowledge which could be used by policy makers to improve their strategies and launch new initiatives in the same field. By providing expertise and scientific advice, each project could feed the information gaps or suggest more suitable policy options to better tackle the identified challenges. Looking at projects funded under FP6 and FP7, the analysis reveals that almost all the projects produced policy advice. In FP6, "SaS-related" projects reported slightly better results compared to other projects, although the samples did not include policy advice as an objective (either primary or secondary). In FP7, the majority of the "SiS-related" projects and "other" projects included policy advice as a primary objective (64% and 63% respectively) but the distance between the two samples increased in terms of outputs: 97% of the "SiS-related" projects delivered policy advice compared to 72% of the FP7 "other" projects. The results show that there was a higher awareness in FP7 of the relevance of delivering outputs which could orientate policy making. However, not all the projects outside the science/society area lived up to the ambitions as some of them did not achieve the stated objectives.

As for the actual policy impact, there are many factors influencing the concrete uptake of recommendations at all policy levels. The state of development of the specific policy, the availability of resources for implementation, the existence and dynamic nature of actors that advocate the project results, the interplay of the interests and even the timeframe of reference, are just a few of the explanatory factors. Thus, regardless of the quality of project outputs and their potential impacts, the final policy impact of different projects cannot be assessed without a case by case analysis.

4.3.1.3 Integration of SaS-SiS activities in FPs

What overlap/complementary existed between specific SaS/SiS activities ("vertical") and embedded horizontal activities (in FP6 programme "Integrating and Strengthening the European Research Area" and in the FP7 Cooperation programme)?

Despite the similarities between SxS programmes and other FP programmes in terms of project results (i.e. policy briefs, policy recommendations) and content of the research, the SxS programmes stand out for their unique features: the involvement of societal actors usually not included in research projects (e.g. schools, NGOs, ethics committees), and the practical nature of the contents of the research (e.g. teaching materials, guidelines for science communication).

FP6 SaS and FP6 Specific Programme "Integrating and Strengthening the European Research Area"

Grouped by different specific programmes, all FP6 activities in the field of science, research and innovation pursued the common objectives of strengthening the scientific and technological bases and competitiveness of industry while promoting the coordination of research activities in Europe. On the one hand, the Specific Programme "Integrating and Strengthening the European Research Area" (hereinafter referred to as "the ERA") covered those areas of high interest and added value for the EU to become the most competitive and sustainable knowledge-based economy in the world. On the other hand, within the programme "Structuring the European Research Area", SaS activities aimed to foster dialogue between the scientific community and society at large. Activities implemented within both programmes were intended to be distinct but complementary to each other. Above all, general societal considerations were already embodied in all the main objectives of the seven thematic priorities identified by the specific programme.[80] Furthermore, some principles were set as common ground for the implementation of both programmes and research activities:

[80] For instance, in terms of: involvement of key players such as practitioners, policy makers, industry and experts on ethical matters; information society technology putting the individual at the centre; more environment-friendly approaches in nano-sciences/technologies; priority to consumers' demands and rights in developing high-quality and safe food; strengthening the S&T capacities integrating its social, economic and environmental dimensions; fostering new forms of relationships between its citizens, and between its citizens and institutions.

- Fundamental ethical principles including those reflected in the Charter of Fundamental Rights of the European Union and international conventions/codes of conduct;
- Gender aspects in research as expressed also by the SaS Action Plan;
- Participation and active engagement of the candidate countries and other associated countries to achieve a full potential.

By comparing the SaS activities with the Strengthening the ERA's priority thematic areas of research, grounds for overlap/complementarity was found in some fields:

- **Governance/civil society engagement**: evolved between SaS activities "Bringing research closer to society" and the Strengthening the ERA activity line "Citizens and Governance in a knowledge-based society". The main objective in SaS was to create the conditions for informed and effective policy decisions that were more soundly based and which took into account the concerns of civil society. Thus, activities mainly focused on improving the policy-making process by developing new forms of involvement (and consultation) of civil society and by ensuring a multi-stakeholder interaction on scientific issues. The Strengthening the ERA programme had a wider scope. It aimed to provide a sound knowledge base in support of the transition to a knowledge-based society including more informed decision making. Therefore, the concept of governance was wider and relevant topics included, amongst the others: options to enhance democratic governance; relationships between integration, enlargement and institutional change; institutional and social capacity in conflict resolution. The Strengthening the ERA programme also carried out research on forms of multi-level governance which were more accountable and legitimate taking into account the role of CSOs and citizens in European policy making. Possible overlaps might occur if such activities aimed to attain a "more effective involvement of civil society organisations" in research as addressed in SaS (FP6 SaS Work Programme, 2006, p.8), or to "*encourage greater public engagement and promote the participation of citizens and civil society organisations in research and science policy- making*" as called for in SiS (FP7 SiS Work Programme, 2007, p. 8).
- **Ethical issues:** between the SaS activities: "*Responsible research and application of science and technology*" and the Strengthening the ERA thematic area of research "*Life sciences, genomics and biotechnology for health*". SaS activities aimed to promote "responsible research" in Europe by taking into account social and environmental responsibilities in the development and application of science and technology. SaS specifically promoted "research on ethics in relation to science, technology developments their applications, for example, in relation to information society, nanotechnologies, human genetics and biomedical research and in food technologies" (Council of the European Union, 2002a, p. 13). Research on ethics was deemed an exclusive competence of the programme "Structuring the European Research Area" (Council of the European Union, 2002b, p. 7). However, consideration of ethical aspects of research also formed a part of the activities under the Strengthening the ERA specific programme, in addition to the fact that an ethical review of the proposals, dealing with ethically sensitive issues, was systematically performed. It is possible to identify some

complementarities between the two programmes as they researched different yet related topics. For instance, SaS specifically carried out research on the ethical aspects of gene therapy and cloning and inconsistencies in current legislation (e.g. REPROGENETICS project). On contrast, the specific programme area "Life sciences, genomics and biotechnology for health" carried out research on the applications of advanced genomics and biotechnology for health, taking into account "*the ethical implications and the broader implications of developments in genomics research for society and citizens*" as part of the research (Council of the European Union, 2002b, p. 9). Experts, patients, and the public were also involved and consulted as appropriate to ensure socially responsible outputs (Council of the European Union, 2002b).

- **Networks of excellence and integrated projects**: these were implemented in the seven priority thematic areas of the Strengthening the ERA specific programme and, when relevant to their objectives, activities focused on researcher training and the promotion of links between science and society, including women in science. Attention was also paid to "*information and communication, and dialogue with the public concerning the science/society aspects of the research carried out within the project*" (Council of the European Union, 2002b, p.41). These activities were also addressed under the SaS programme, specifically under the Activity Line "Stepping up the science/society dialogue and women in science" supported public awareness and knowledge of scientific and technological advances in society, researches' training as well as specific actions to promote a better understanding of the gender issue in science (Council of the European Union, 2002a, p. 13). Depending on the specific topic, some overlaps might arise.

FP7 SiS and FP7 Specific Programme Cooperation

As part of the "Capacities" programme, SiS intensified the efforts made by the SaS programme in order to set a social and cultural environment conducive to successful and exploitable research by integrating societal concerns and needs in science and technology. All the activities were directed at fostering the integration of science in society by tackling the root causes of the modest participation of people in the world of science. SiS issues were promoted and supported in other parts of the Framework Programme for its full implementation (Council of the European Union, 2002, p. 14). Thus, monitoring the uptake of SiS issues within different programmes is key to avoiding overlaps. The "*Cooperation*" programme, for instance, supported transnational cooperation in ten thematic areas corresponding to the major fields of progress in knowledge and technology, where support for research was needed to address European challenges towards sustainable development. As announced in the Council decision concerning the Seventh Framework Programme, it was essential to find *"complementarity and synergy between this programme and other Community programmes"* (European Parliament and Council of the European Union, 2006a, p. 8). Looking at the programme's activities, complementarities emerged in relation to:

- **Governance/civil society engagement.** Within the socio-economic sciences and the humanities field, the cooperation programme supported an effective, democratic and innovative governance at all levels. Some activities specifically aiming to foster the role of civil society and public-private cooperation to enhance citizen's participation and ownership ("*The citizen in the European Union*"). More specifically, the cooperation programme carried out an interdisciplinary research on the different forms and practices of democratic participation by citizens in Europe in order to increase awareness and information. It also provided structural support to CSOs as a unique link between citizens and the European Union. The expected impact of such action was *"the involvement of relevant civil society organisations in the research activities"*.[81] Similarly, SiS encouraged a greater public participation and a more inclusive involvement of CSOs in research and science policy making ("*Broader engagement to anticipate and clarify political, societal and ethical issues*"). The aim was to turn civil society into a driver and locus for innovation and be an *"active player in building a democratic knowledge society"*.[82] Both programmes addressed the need to engage CSOs in different research fields. Thus, forms and practices tested by projects could be exchanged for improving current strategies of stakeholders and the involvement of community representatives.

- **Ethical issues.** Research on the ethical implications of science and technology was carried out under the SiS programme ("*Broader engagement to anticipate and clarify political, societal and ethical issues*"). The outputs of the research on ethical aspects provided a knowledge base for programmes focused on other areas of research. Ethics was particularly relevant to the health theme in the cooperation programme as it carried out research involving human beings, human embryonic stem cells, biological materials and animals. The cooperation programme clearly stated that ethical considerations were part of all the activities within the health theme (European Parliament and Council of the European Union, 2006a, p. 11). Research conducted under the activity lines "*Biotechnology, generic tools and medical technologies for human health*" and "*Translating research for human health*", were concerned with ethical issues as they aimed to predict the suitability, safety and effectiveness of therapies and at conducting innovative clinical trials. In sum, the research topics were different but ethical aspects had to be considered. As evidence of such commitment:
  - All applicants were requested to address the potential ethical aspects of the proposed research regarding its objectives, the methodology and the possible implications of the results;[83]
  - Specific requirements for addressing ethical issues were described in the Guide for Applicants;
  - Experts in ethics, law and social sciences were encouraged to participate actively in research projects.

  Generally, there was a complementary relationship between the two programmes in the field of ethics. Just in one case did health research include activities for the development of new ethical standards for clinical trials posing a threat of overlap with SiS activities.[84]

[81] FP7 COOPERATION Work Programme 2008. THEME 8. SOCIOECONOMIC SCIENCES AND HUMANITIES. Page 30.
[82] FP7 SiS Work Programme (2007). Page 5.
[83] FP7 COOPERATION Work Programme (2007-2008). THEME 1. Health. Page 11.
[84] The PREDICT (Increasing the PaRticipation of the ElDerly In Clinical Trials) project researched on the reasons for the exclusion of elderly in clinical trials to provide for solutions for their underrepresentation. Based on the views of health professionals, ethicists as well as older patients and careers, the project developed a European charter for the elderly in clinical trials.

- **Scientific advice and expertise for policy making**. Improving the use and monitoring the impact of scientific advice and expertise in the policy-making process was the scope of a SiS Activity line (*Strengthening and improving the European science system*). Similarly, the cooperation programme aimed to attain sound policy making by improving the knowledge base, setting quantifiable targets and providing scientific advice. Within the energy theme, for instance, activities referred to the provision of scientific support for policy development (*Knowledge for energy policy making*).
- **Gender-related issues**. SiS planned positive actions to both reinforce the role of women in scientific research and to enhance the gender dimension of research (*Gender and Research*). The cooperation programme addressed gender-related issues under the Socio-Economic Sciences and the Humanities theme. The scope of such effort was not just to ensure a balanced representation of women and men in research projects, but also to look at the gender dimension of research. As underlined in the WP "*the gender dimension of the research content should be addressed wherever relevant in the topics*".[85]

Overall, the activities carried out under the cooperation programme were directed at meeting societal challenges through the provision of new knowledge, structures, technologies and services responding to emerging societal needs. In order to attain a sustainable development, it was essential to modernise the European industry base, paying attention to the potential applications of technologies in many domains (i.e. ICT, nano-science and technology, energy, environment) for the solution of societal problems. Generally, the relationship between the SiS programme and the Cooperation themes was complimentary. Potential overlaps were marginal and might have occurred in the implementation of a limited number of topics.

What evolution can be identified with regard to vertical versus horizontal activities, also in relation to previous (FP5 and FP4) and future (Horizon 2020) actions?

Over the years, the EU Framework Programmes have modified their structure and contents to respond to the new challenges and emerging needs in Europe. Despite the differences, there is an evolutionary path from FP4 to the ongoing Horizon 2020, as every new Framework Programme has built on the achievements and progress made by the previous one. Activities funded under each specific programme have changed their focus and scope and improved the approach and methodologies to better tackle the challenges ahead. An overview of this evolution is provided below.

The 4th Framework Programme included all the Community activities in the area of research and technological development, structured in specific programmes with precise objectives and rules. Amongst the specific objectives, the programme aimed "to anticipate technological and industrial changes so as to ensure that greater account is taken of market and society's needs" (European Parliament and Council of the European Union, 1994). The overarching objective was to increase the competitiveness of European industry by attaining a harmonious development of its scientific and technological resources. In doing

[85] FP7 COOPERATION Work Programme 2008. THEME 8. SOCIOECONOMIC SCIENCES AND HUMANITIES. Page 9.

so, European research was directed at solving societal problems. Indeed, the 4th FP First Activity Line covered the majority of research, technological development and demonstration programmes which were expected to contribute to the satisfaction of society's needs for a better quality of life. The "Other Activity" lines focused on the strategic blocks of European industrial and commercial competitiveness responding both to economic and societal demands. The specific research line "*Targeted socio-economic research*", was introduced in the FP to consider relevant socio-economic impacts/aspects in all research activities. The main objectives were: to enlarge the knowledge base for decision making, to increase public understanding of science, and to strengthen "the interface between science, research and society". Thus, partial correspondence could be found in the scope with future science/society topics under the future FPs. However, in FP4, society was mainly perceived as a beneficiary rather than an actor in the innovation and technological process. Consultations to shape science and technology policy options at European level involved, at the time, scientific, technical and industrial bodies and not the society as a whole.

The 5th Framework Programme also aimed to reinforce European competitiveness and sustainable development by exploiting the knowledge gathered in some research areas to elaborate scientific and technological solutions to merging problems and society's needs in Europe. Human beings were put at the centre of an integrated system approach towards a better quality of life and efficient resource management. For the first time, human rights and fundamental ethical principles - not just ethical considerations - were fully taken into account and some gender issues were deemed relevant for the implementation of the FP.[86] As for ethics, an activity line[87] specifically focused on ethical aspects of life sciences research in order "to identify the ethical, legal and social questions raised, not only by medical and biological research alone but also, more broadly, by scientific and technological developments" (Council of the European Union, 1999, p. 16). The objective was to favour public debate about emerging issues, which would improve quality of debate by shedding light on the socio-economic impacts of life sciences and technologies. The underlying idea was that there were interrelations between technologies, the environment and society. Finally, socio-economic research and training of young European researchers were an integral part of this programme also supported through the horizontal programme "*Improving human research potential and the socio-economic knowledge base"* (Fourth Activity). The strategy for the implementation of the Key Action on socio-economic knowledge base, referred to the establishment of mechanism for dialogue between researchers, civil society, organisations, policy makers and the Commission. In summary, FP5 urged the need for better understanding the links between science and policy which could be enhanced through the dissemination of information to the public. Promoting scientific culture amongst the public and enhancing the role of civil society in policy making, were key objectives of the SiS programme. Thus, FP5 contained the roots of the future evolution.

[86] The focus was mainly on the need to encourage the participation of women in the fields of research and technological development. Moreover, the forth activity line aimed to develop the Community's human research potential by ensuring a better balance between men and women especially through training and mobility of researchers.

[87] The activity was entitled "Study of problems relating to medical ethics and bioethics in the context of respect for fundamental human values".

The analysis of the previous FPs shows that despite the lack of a specific programme dedicated to science/society topics, societal concerns emerging from science and technology were already present as cross-cutting issues in the research themes of FPs. FP6 and FP7 formally recognised the relevance of SxS issues and the need to address them within specific programmes different from, but connected to, other fields of research. SaS/SiS programmes were structured in parts, and action/activity lines where many aspects of the links between the scientific community and society were examined. The achievements and lessons laid the groundwork for the actions funded in Horizon 2020.

The current SwafS programme aims to build effective cooperation between science and society and to combine a higher European scientific excellence with wider social awareness and responsibility. In line with the previous programmes, SwafS aims to foster European global competitiveness, public and private investments, as well as to attain sustainable development for citizens and the whole economy. To achieve such objectives, SwafS activities are grouped in 8 specific lines: the attractiveness of scientific and technological careers to young students; gender equality in research institutions and activities; integration of the interests and values of citizens in the research and innovation process and outcomes; citizen engagement in formal and informal science education; accessibility and use of research results; governance for the advancement of RRI; anticipation and assessment of potential environmental, health and safety impacts of R&I activities; improved knowledge on science communication between scientists, media and the public (Council of the European Union, 2013, p. 67). Six of the above-mentioned broad lines mirror the high-level objectives of SxS. The analysis of the WPs shows that the evolutionary path from FP6 and FP7 to Horizon 2020 in science/society issues is characterised by a broadening of the focus in each thematic dimension thanks to the integration of innovative concepts and topics. Clearly, specific topics and approaches to implementation might vary along with the priorities set in the research agenda and the identified societal challenges. The underlying rationale is to increase the effectiveness of initiatives by better aligning the solutions to societal needs and aspirations.

With regards to its distinguishing features, SwafS shows a stronger orientation towards innovation in society and research activities as a main driver of progress. A milestone of this new approach is the concept of Responsible Research and Innovation (RRI) which seeks to embed the value, needs and expectations of European society in the research and innovation (R&I) process. The effort is to develop R&I policy which takes into account and even anticipates the societal implications of the process. Several science/society issues including citizen engagement, open access to scientific results, gender equality in research, ethics and science education, are to some extent embedded in the new cross-cutting concept across Horizon 2020. Therefore, SwafS aims to attain the widest possible implementation of RRI in research and innovation policies and practices by removing existing barriers at national, European and global levels.

From this perspective, the concept of RRI is expected to increase the efficiency of R&I investments and to better tackle global societal challenges by fostering knowledge and innovation co-production through continuous engagement with society. In the long-term, the action will inaugurate a structural change in R&I systems.

4.3.1.4 From Science and-in Society to Horizon 2020

How do SaS/SiS activities and other relevant horizontal activities compare (benchmark) to similar activities programmed and carried out in Horizon 2020?

The SaS/SiS programmes sought to improve the link between science and society by integrating societal concerns and aspirations in science policy making and research agenda. The activities funded under both programmes addressed specific topics and challenges with the view to improving general understanding of the role and value of science amongst the public and to prompt wider participation/engagement of citizens (especially young people and women) in the world of science. As underlined in the SwafS WP 2016-2017, the effort for opening research and innovation activities to societal actors and concerns through a two-way dialogue is pursued and intensified in the new programme.[88]

Under the umbrella concept of RRI, the involvement of societal actors and societal concerns becomes more systemic in the six dimensions and oriented towards the production of practical and innovative solutions for society. In order to ensure the concrete uptake of projects and programme outputs, closer involvement of the industry is also pursued.[89] By comparing the structure of SwafS WPs (2014-2015 and 2016-2017) with the previous structure of SaS and SiS, it is possible to identify some similarities in the main objectives pursued through activities and actions related to similar themes. Overall, improvements were made in the definition of the specific objectives, as well as in the expected impacts for each topic.

Differences and innovative aspects of SwafS are highlighted for each dimension as follows.

Gender and science. Activities funded under the FP7 SiS demanded active promotion of women in scientific research through gender mainstreaming. The objective was to boost gender equality in research, by stimulating the participation of women in science and technological development and fostering the integration of the gender dimension throughout European research. Accordingly, promoting gender equality in research and innovation is a key priority of SwafS. Many topics address gender issues, showing the importance of this dimension in RRI (e.g. GERI calls). The objective is to support structural changes in research institutions and the integration of the gender dimension in the content and design of research activities.[90] SwafS introduces some innovative topics. Firstly, the programme adopts an innovative approach to encourage girls and female students to embrace a career in science and monitors/assesses the impact of gender diversity in research and innovation performance. Secondly, SwafS calls for evaluating gender equality initiatives and for supporting research organisations in implementing gender equality plans. Thirdly, the programme seeks to build a European community of practice to support institutional change in the centres of research experienced in gender equality activities (SwafS-08-2017). Some aspects tackled include barriers regarding recruitment, career progression and gender imbalances in decision making. By sharing lessons learned and expertise from institutional change projects, a spill-over effect from more advanced to less experienced centres/stakeholders is likely to emerge. Thus, SWAFS' activities are more

[88] SwafS Work Programme 2016-2017. Page 6.
[89] Some calls specifically address this issue (e.g. GARRI.2.2015; SwafS-06-2017).
[90] SwafS Work Programme 2014-2015. Page 14.

directed at research organisations,[91] educational establishments and policy makers.

Science literacy. The objective of activities funded under the FP7 SiS was to attract young people to careers in science and to raise the general level of scientific literacy so that there was higher awareness of the impact of science on society. On the one hand, SiS activities looked at on-going initiatives on science education to drive a radical change in young people's attitude to education in science. On the other hand, effective two-way communication channels were promoted to enable the public and policy makers to engage with science, and scientists to engage with the public. Accordingly, SwafS strives to make science education and careers attractive to young people (e.g. SEAC calls) and to improve the science literacy and responsibility of citizens. To achieve the latter, SwafS values interactive exhibitions, participatory events, high-level workshops and sites (i.e. "science cafés") using multimedia and relevant technology to engage with multiple public audiences. However, several innovative features were introduced in Horizon 2020. To stimulate the interest in science careers, actions may adopt innovative, forward-looking science education methods, informal pedagogies, open access to educational resources and other incentives. More emphasis is put on entrepreneurial and multidisciplinary research careers linked to market needs and hence more likely to be attractive to younger generations. Special attention is also paid to girls' access to scientific careers and making careers more attractive to girls. Interestingly, SwafS activities also promote the uptake of the new RRI concept in higher education curricula with the twofold purpose of shaping responsible and responsive research and providing EU higher education institutions (HEIs) with a competitive advantage against global competitors. Finally, the concept of "open schooling" is supported, which sees collaboration between formal, non-formal and informal education providers, enterprises and civil society.[92]

Open access, open science. SaS and SiS encouraged debate on information dissemination, including access to scientific results and scientific publications as well as measures to improve public access to them. The main objective was to improve the performance of the European science system and its ability to produce robust and reliable knowledge, to support policy making and respond to social needs. Building on the lessons learned from the previous programmes, SwafS acknowledges the need for systematic cooperation and a shared knowledge base for policy making (e.g. ISSI calls). A key action is the development of a Knowledge Sharing Platform (KSP) to scale up experiences and know-how from the RRI communities using a repertoire of exchange tools and participatory processes targeting businesses, policy makers and CSO organisations. Compared to the previous FPs, SwafS expands this thematic dimension by increasing efforts towards open science and innovation in line with the "Three Os" vision for Europe.[93] Open science allows a more dynamic circulation of knowledge, scaling up the benefits of research and facilitates the provision of socio-economic value. Consequently, open science has gained momentum in the ongoing programme as a driver of innovation and responsive

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[91] The action refers to Research Performing Organisations (RPOs), including Higher Education Institutions, and Research Funding Organisations (RFOs).

[92] SwafS Work Programme 2016-2017. Page 33.

[93] "Open Innovation, Open Science, Open to the World" are the three goals set by Commissioner Carlos Moedas for EU research and innovation policy. The vision reinforces the initiatives funded under Horizon 2020 and establishes links between the programme and higher policy priorities. See more at: http://ec.europa.eu/newsroom/dae/document.cfm?doc_id=16236.

science. As evidence of this evolution, specific actions are planned to prompt the use of Text and Data Mining (TDM) infrastructures by researchers and innovative businesses as tools for the co-creation of knowledge. Training on open science and its applications for researches and academics is also provided in order to harmonise practices and to develop a common culture of open science amongst a large number of European stakeholders. Horizon 2020 recognises the need to operationalise the Open Science rationale by involving CSOs, industry, government and academia in a knowledge coalition for the production of RRI solutions which better tackle current challenges.

Science and Ethics. Activities funded under FP7 focused on the promotion of the integration of society's aspirations and concerns, and fundamental ethical principles in research policy by carrying out research on the ethical implications of science and technology applications and sharing good practices. The ethical dimension of research gains a broader space and relevance in SwafS WPs. In fact, a wide range of activities is dedicated to this thematic dimension. Firstly, the ongoing programme promotes the adherence to high standards in research integrity to tackle the heterogeneity of existing codes, principles and to enact ethical spill-over from academia to industry. Secondly, SwafS introduces the concept of "ethics dumping" to refer to unethical research practices conducted by EU organisations outside Europe and possible actions to mitigate this risk. Thirdly, the programme promotes a practical approach to ethics by developing estimates of the social and economic benefits of research integrity or of the impacts of research misconduct for an efficient research integrity policy. New ethical issues arising from specific sectors are also addressed to provide for practical responses (i.e. informed consent in medical research; ethical perspectives in genomics, human enhancement and human-machine interactions; privacy in ICT). Finally, training activities based on the "train-the-trainer" principle are organised to promote compliance to the highest ethical standards in the EU amongst all the relevant stakeholders.

Governance and Scientific Advice, RRI. SaS and SiS activities in this dimension aimed to implement open governance approaches to support a broader engagement of civil society in science. In parallel they aimed to provide for a wider collaboration and knowledge-base for sound policy making. In Horizon 2020, the concept of RRI provides a reference framework for all research and innovation activities. The main objective is to engage society at large by establishing close cooperation between all stakeholders across the process of R&I. Activities are primarily directed at identifying RRI aspects in different parts of Horizon 2020, making use of different tools for public engagement including co-creation. SwafS introduced new focus on "innovation value chains" and industrial processes and organisations more generally. The objective is to develop a sound knowledge base for policy orientation in innovation which can stimulate institutional change and make progress on RRI practices (e.g. GARRI calls). Compared to the previous FPs, Horizon 2020 adopts a global approach to RRI issues to raise awareness of their relevance in order to gain a competitive advantage. Global networks are involved, along with relevant stakeholders from academia, international organisations, businesses, NGOs, policy makers and research funders. The pooling of resources and channelling of expertise will help to identify the ethical and societal challenges and to select the most suitable policy options for evidence-based policy making. Finally, the concept of RRI and the expertise of R&I stakeholders will contribute to sustainable, ethically acceptable and socially desirable outcomes.

Civil society and citizen participation. The objective of SiS activities for this dimension was to encourage broader engagement of the public and a wider participation of CSOs throughout the research process in order to create a more constructive environment for researchers and for society as a whole. The participation of society was deemed key to gaining stronger support for scientific research programmes and technological innovations in Europe. As underlined in the ICF evaluation of SiS (ICF Consulting Services, Delft University, Facts of Life and Technopolis, 2016, p. 46), the main evolution during programme implementation was the shift from science communication (mainly realised through exhibitions and science events) to a two-way, multi-actor and citizen engagement for the sharing of data, knowledge, and expertise. Horizon 2020 is aligned with this trend as public participation remains a key priority in SwafS. It aims to carry out multi-actor engagement connecting scientists, stakeholders and citizens from Member States and selected Associated Countries to address the emerging societal challenges of Horizon 2020. Some activities develop methodologies for the definition of research, innovation and public policies, taking into account the wider impact on technology, society, the economy, gender, health, and the environment. Supporting tools include, for instance, inclusive workshops, participatory multi-criteria analysis, and citizen-focused consultations. In addition to traditional approaches to public engagement, SwafS introduces an innovative topic in the field which hinges on the concept of "co-creation" of innovative solutions, products and services. The ambition is to provide a unique framework for all sorts of initiatives aiming to integrate society in science through the construction of spaces of public engagement and society sensitive design. Clearly, the programme looks at an "implementable integration" meaning that only achievable outcomes and effects will be considered in the activities. The expected result is the engagement of citizens and stakeholders in envisioning socially desirable futures of R&I policies and thus, better-targeted policy solutions in the future.

In line with the approach to horizontal issues taken by previous programmes, SwafS underlines the need to identify and leverage complementarities and cross-cutting issues between different activities under Horizon 2020, especially in relation to RRI, science education/communication and gender.[94] The Scoping Paper for SwafS explicitly defines the existence of links between the specific programme activities and other activities of Horizon 2020, notably in parts II, III and VI. Evidence of this cooperation is the inclusion of gender issues in more than 100 topics of the 2014-2015 WP as well as bilateral contacts and workshops to embed RRI within the ERA.[95]

How did SaS/SiS activities contribute to the shaping of the content of the "Science with and for Society" objective and the RRI cross-cutting action in Horizon 2020? Did the SaS/SiS activities contribute/influence the overall architecture and objectives of Horizon 2020 in any significant way?

The SiS programme had a considerable impact on the development of SwafS and the mainstreaming of RRI issues within H2020. The cross-cutting mechanisms for the integration of RRI issues in the Framework Programmes, such as ethical reviews, regulations on gender balance and open access, and provisions regarding the composition of evaluation panels, are important RRI innovations, but this study confirms ICF (2016): "Yet, no evidence was found to suggest that activities funded by SiS directly led to any of these changes".

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[94] Council Decision 2013/743/EU. Page 12.

[95] Scoping Paper for Science with and for Society. Annex 18. Retrieved from: http://www.h2020.md/en/science-and-society-scoping-paper

Even though it is most likely that the SaS and SiS activities contributed to shaping the content of the SwafS programme and the cross-cutting actions, it is nearly impossible to identify evidence on direct cause-and-effect relations. Interviewees confirmed a broad consensus on thematic continuity from SaS, to SiS and in turn to SwafS but had difficulties in isolating the contribution of those programmes from other drivers (e.g. Member States and the European Parliament).

The main changes relating to the cross-cutting dimension of RRI introduced in H2020 can be summarised as follows:

- **RRI and gender:** Regulation (EU) No 1291/2013 establishing Horizon 2020 makes reference to RRI and gender as cross-cutting issues. In April 2016, the European Commission published guidance on gender equality in H2020[96] which explains on how to integrate gender issues in programming, implementation, monitoring, and programme evaluation.
- **Ethics:** Regulations on ethical reviews and audits were already included in the rules for participation in FP7 (Regulation (EC) No 1906/2006). Article 10 of the rules for participation (Regulation (EC) No 1906/2006) and Article 6 of the Decision on the Seventh Framework Programme (Decision (EC) No 1982/2006) implicitly mention ethical reviews for proposals of research implying physical interventions on human tissue, human foetus, and primates as well as for proposals which reported other potential ethical issues. Article 14 of regulation (EU) No 1290/2013 on the participation in Horizon 2020 requires that all proposals above a specified funding threshold be subject to an ethical review by ethics review panels which should verify "the respect of ethical principles and legislation and, in the case of research carried out outside the Union, that the same research would have been allowed in a Member State". In the case of a substantial breach of ethical principles, research integrity or relevant legislation, the Commission can carry out an ethics audit.
- **CSOs:** Article 40 of regulation (EU) No 1290/2013 allows the participation of CSO representatives as independent experts involved in the evaluation of proposals and programmes, monitoring of projects and the development of research policies.
- **Open access:** Decision No 1982/2006/EC acknowledges the need to ensure the dissemination of results although it made no explicit reference to open access. However, during FP7 the European Commission tested mandatory open access for a small selection of projects (Open Access Pilot).

Regulation (EU) 1290/2013 requires participants to disseminate their own research results "as soon as possible" (Article 42 of Regulation (EU) No 1290/2013). The rules of participation also requires the publications and data resulting from H2020 research to be open access across the Framework Programme.

[96] http://eige.europa.eu/sites/default/files/h2020-hi-guide-gender_en.pdf

4.3.2 Beyond Europe: the EU added value of Science and-in Society

4.3.2.1 The contribution of SaS-SiS programmes to national activities

What is the impact of the SaS/SiS projects and programmes on policy development at national level?

National level policy makers and the member of the MASIS expert groups that were interviewed recognised that SxS projects contributed in some ways to the development of national policies, although with marked differences across countries.

The general perception seems to be that effects are still limited in this regard. The low impact on national policies seems to be confirmed by the limited rate of participation of government representatives in this study (indeed, most of the 53 contacted national policy makers declined our invitation because they were not sufficiently aware of the SxS programmes).

Amongst the most reported impacts, SaS/SiS programmes contributed to raising national debates on the key dimensions. During programme implementation, a number of related initiatives were launched at national level. For instance, in the Netherlands there was a public consultation on the national research plan, in Austria a public consultation for Open innovation, and in Italy there were exchanges between AIRI (Associazione Italiana per la Ricerca Industriale) and the Ministry of Research on the design of a national research plan and the integration of the concept of responsible science.

Some specific aspects can be highlighted per dimension, as further described below.

Gender and science. According to the experts consulted, the SxS programmes contributed to stimulating gender and science policies in several countries. For example, the results of the BASNET project influenced national strategies on how to tackle the gender equality problem in Lithuania, Latvia and Estonia. They were also used when formulating the Baltic Assembly (Parliamentary) Resolution No. 31 that included the need to promote gender equality in research organisation in the Baltic States region.

Open access, open science. The implementation of policies at national level in this area is quite complicated because of the specific nature of the different national legal systems. The EU has been a driver, setting minimum standards and Member States have implemented the strategies on open data due to the Commission’s activities.

Science literacy. As reported by an EC official, there are cases of SxS projects influencing national policies. For example, in several countries, there are science competitions that are aligned with those organised at the EU level. However, independent experts interviewed in this area could not mention other examples of broader policy uptake.

Science and ethics. Examples of impact of the SaS/SiS projects and programmes on policy development at national level were mentioned by different experts interviewed. For example, Austrian policies that are implemented in the area of ethics comply with FP7 rules. However, another expert pointed out that it is hard to explain the impact of SaS/SiS programmes on Austrian policies. These contradictory stances show the difficulty to measure the direct impact of SxS programmes on national policies.

Governance and Scientific Advice, RRI. The interviews provided evidence of existing policies in national policies. However, the direct impact of the SaS/SiS projects and programmes on policy development is not always straightforward:

- According to one of the interviewed experts, the Netherlands Organisation for Scientific Research funds started its own Responsible Research and Innovation programme (RRI) under the same line as the SxS programmes (it is almost a copy of the SiS programmes). Even if a direct link between the development of the Dutch programme after the SaS/SiS programmes cannot be identified, this shows that topics in SaS/SiS are embedded in national policies and are considered to be of high importance.
- Moreover, in Austria increased emphasis has recently been placed on responsible science. For example, in 2015, the Ministry for Science, Research and Economy created an alliance with other institutions to promote responsible research.

Civil society and citizen participation. The interviews also provided evidence that the civil society and citizen participation dimension is embedded in some national policies:

- The EU programmes had some influence in Switzerland. As an example, one of the experts underlined the direct link between the French-speaking programme in Switzerland "*Science et cité*" (which promotes dialogue between citizens and science) and the EU programmes;
- Another interviewee recalled that in Austria, citizen participation has, to a certain degree, been included in national programmes. According to the interviewee, this would not have been done without the implementation of the SxS programmes;
- Another interviewee commented that in the Netherlands, the National Research Agenda was launched in September 2016. The Agenda is based on a bottom-up approach which drew on the contributions of the general public and industry - and not just the expected stakeholders - to help define research priorities. The Agenda is composed of 140 overarching scientific questions.

As for the state of play of SxS policies in MS and overlaps with EC-funded activities, the main points reported in the ICF Final Report (2016)[97] and in the MASIS Synthesis Report (2012)[98] can be summarised as follows:

- **General**. Only five Member States run *ad hoc* funding for Science in Society and RRI research;
- **Science in society in Europe is dominated by certain themes**: Issues related to the role of science and technology for sustainable development and issues related to the governance of science are dominant in the national debates emphasised in the reports;
- **Overlaps between EU and MS**. Only five Member States run dedicated funding programmes that are comparable to FP7 SiS and fund activities

[97] This rely also on the findings of the project ResAgorA.
[98] The main activities of the MASIS project were the design, collection, validation and update of 38 national reports on science in society, and the creation, maintenance and update of the MASIS website (www.masis.eu) as well as the facilitation of a MASIS community and collection of information (news) pertinent to MASIS from the 38 countries (EU 27 plus 11 associated countries at the time).

similar to those funded under individual FP7 SiS themes. Germany, Spain, Portugal, the Netherlands, and Belgium are the five Member States which have programmes which could have potential overlaps with FP7 SiS funding. Other MS integrated SiS aspects into their mainstream programmes;

- **The EC Framework Programme provides key value added in understanding the role of science in society**. With regards to research activities and priorities related to science in society, the national reports point at significant efforts in several areas, including governance of science, public understanding of science, science communication, science education, and ethics in science and technology. Science in society is generally not considered a coherent and well-defined research field, and several correspondents note that continued research efforts relating to science in society are dependent upon the EC Framework Programme support structure. Advances in the understanding of the appropriate place of science in society thus depend on a collective European commitment to supporting further research within this area;
- **Increased responsiveness by higher education to societal demands**: Significant reforms of higher education institutions, combining increased autonomy and professionalisation of management, have swept across Europe and have stimulated a higher degree of responsiveness towards societal demands, particularly in the shape of increased science – industry interaction;
- **Heterogeneous models and levels of public engagement in science and technology decision making in Europe**: While many countries have formalised procedures and opportunities for involving citizens in priority setting and assessment related to science and technology, the actual degree of public involvement differs markedly, and in some countries, nascent civil societies, lack of appropriate institutions, or non-inclusive political culture, form barriers for a more democratic and inclusive governance of science and technology. The issue of 'upstream engagement', which has a certain relevance at the EC level, seems to have only moderate saliency in many Member States;
- **Significant differences in the use of scientific knowledge and advice in decision making**: Many countries experience a growing concern with developing infrastructures for feeding scientific knowledge and advice into political decision-making processes. In some countries, formal procedures and institutionalisation do not de facto ensure a high use of science-based knowledge in decision making. However, other countries have both well-established traditions and institutions and an extensive use of science in decision making, particularly within policy areas such as health and environment;
- **Three categories of 'science communication culture'**: Based on six parameters of science communication activity, a framework for assessing and categorising 'science communication culture' was developed. Three distinct clusters of countries were identified, namely countries with a 'consolidated', 'developing', and 'fragile' science communication culture. Within each of these categories, countries display similar characteristics and report on similar challenges. Science communication culture tends to interconnect also with issues relating to governance of science and public involvement in science and technology decision making.

The analysis of the case studies shows there are a few instances reporting that the project results were adopted/used by national or regional government and international organisations. Many projects report that their output should and could be used in policy making at various levels but there is no documentation that this occurred, with the exception of the following projects:

- Project Enhance (SSA/FP6-related) recommendations considered by WMO, other UN system organisations;
- The Hellenic Centre for Infectious Diseases Control used recommendations of SACRIMM project (SSA/SaS);
- Results of the Meadow project (CA/FP6 related) reported being used by Luxembourg Government, World Bank, and the OECD;
- In at least two countries, the Ministry of Education showed an interest towards the activities of the Engineer project (CSA/SiS).

Overall it can be concluded that SaS/SiS projects and programmes have some impacts on policy development at national level, but this could be higher and increased. Yet, the transmission mechanism from projects results to actual national and regional policies should be reinforced.

- The added value of SxS programmes was higher when activities involved newer Member States or low-resource countries with internal resistance to reforms in the institutional context (e.g. the Baltic States). Where there are no comparable resources at national level which could provide an input to institutional and policy change, the programme was key to driving critical changes in national research agendas.
- Overall, the added value of SxS programmes mainly lies in the design of common frameworks and sharing of good practices and lessons learnt that can be applied at national level. SxS programmes represent a supranational forum for discussion where gender, ethics, education, open science, civil society participation and scientific advice can be addressed freely and far from national political interests and cultural backgrounds. These programmes create a level playing field, giving the opportunity to all types of actors to have a voice and actively participate in the discussion on scientific matters, and may favour the identification of common and high-level approaches. Since major responsibilities on science-society issues lies at national level, the added value of SxS programmes consists in the anticipation of societal challenges and in the development of valuable and breakthrough approaches to face them.

How do SaS/SiS activities and other relevant horizontal activities perform, compared to (1) similar activities carried out by Member States at national level, and to (2) similar activities carried out by non-EU R&I intensive countries (including the US and Japan)? How do SaS/SiS projects and programmes contribute to the global debate on SaS/SiS? What is the international cooperation dimension (non-EU) of SaS/SiS projects and programmes? Is there evidence that SaS/SiS contribute to European global excellence regarding SaS/SiS?

Are there overlaps of activities between EU and MS level? Have they led to synergy or duplication of efforts?

A common opinion of the interviewed experts was that there are only a few policies at national level, in Europe, which are similar to the SxS programmes. These national policies tend to be more oriented at having a direct implementation at local/national level rather than focusing on general fundamental issues (which is typical of SaS/SiS projects). A common opinion amongst the interviewed experts was that in the academic environment, projects funded at the EU level were regarded as more important than national ones and as having a broader international perspective.

Gender and science. No specific national programmes were mentioned by gender and science experts as being relevant to a comparison to the SxS programmes. At an international level, two experts on "gender and science" mentioned the Gendered Innovation[99] Framework Programme of Stanford University, built in partnership with the European Commission, as being a very good example of an effective programme aimed at fostering gender innovation. This programme is considered to be more transparent and effective especially in communicating the results of the financed projects, aspects considered not sufficiently developed in the SxS programmes. Project coordinators are responsible for a continuous update of the results of their projects on the programme website. In this way it is possible to picture the evolution of the implementation of the entire programme and results are visible and accessible at every moment during and after the programme.

Open access, open science. As reported by an independent expert, at a national level, initiatives struggle to define the degree of implementation of open access policies due to copyright and restrictions for using intellectual property. In this dimension, the EU interventions are a "blueprint" for national interventions. Most MS do not have policies in this relatively new area and thus are looking with great interest at what the Commission is doing. On an international level, in countries like US and Japan, there is growing debate on this topic, especially regarding the concept of Open Science. However, the EU is still considered to be a forerunner. In Japan, the government is developing an open access infrastructure looking at the achievements of the EU.

Science literacy. One interviewed expert stated that there is a growing number of policies in science education in MS. In national policies, a greater importance than before is given to the engagement of different stakeholders and to the idea that greater effort should be put into activities dedicated to science communication. Usually, these policies tend to put a greater focus on digital innovation, however national policies lack the aspect of cooperation. No specific mention of initiatives on an international level were made regarding the science literacy dimension.

Science and ethics. Various experts underlined the influence of the EU in the field of "Science and Ethics". According to one of them, SxS programmes are setting the agenda on this topic and the national levels follow.

Governance and scientific advice, RRI. The experts acknowledge the impact of the EU programmes on the Governance and Scientific Advice, RRI dimension. As an example, an expert explains that Austria has become a front runner on responsible science issues thanks to the amount of research that was carried out before and the light SxS programmes shed on this topic. Another expert explains that some issues such as RRI could not be covered at national level and that the EU is the correct level at which to tackle this issue.

Civil society and citizen participation. The "Science Shops" are a counter-example to the idea that only national projects have concrete and direct impact

[99] https://genderedinnovations.stanford.edu/

at regional and local level. Indeed, the science shops funded by SxS programmes had a very concrete local impact.

4.3.2.2 The EU added value of SaS-SiS

Do project outcomes demonstrate European added value? (e.g. complementarity, leverage of national efforts)

On the whole, projects funded under the SaS/SiS programmes had a strong European relevance and significance. Above all, SaS/SiS issues were not broadly addressed in national debates - with the exception of ethics - as greater attention was paid to hard sciences and technologies. To build a knowledge-based society, it was essential to engage society in research and to embed societal concerns in all activities. In addition to the actions led by Member States, the projects added value by demonstrating that integrating science in society was possible. The major achievement was the enhanced visibility and relevance gained by science and societal issues across Europe. The Case Study analysis shows that SaS SiS project outcomes demonstrated strong EU added value by providing:

- Common understanding of key concepts for more coherent approaches and interpretations amongst different Member States;
- Availability of EU-wide data and sources of information not accessible at national level to better inform policies;
- Identification of normative frameworks of reference enhancing legal certainty;
- Successful coordination between science organisations leading to a greater effectiveness of action;
- Exchange of best practices in different participating Member States to improve the common knowledge base at EU level;
- Economies of scale for high-quality research which is able to address emerging societal concerns;
- New models and mechanisms to engage with societal actors at regional, national and European level;
- EU-wide reflection on emerging issues related to ethics, gender and education;
- New techniques and methods to improve existing national systems in line with the trends of the market;
- Provision of EU funding to overcome institutional and financial barriers to the elaboration of national strategies;
- Networking to enhance the research capacities of scientists and their role/power in policy making at all levels;
- Two-way communication between institutions and the public, to ensure sound policies thanks to the feedback received.

The above-mentioned factors illustrate the value the programme had for participating organisations, institutions, and Member States. The added value was more evident when activities involved newer Member States or low-resource countries with internal resistance to institutional reforms. Generally, there were no comparable resources at national level which could provide an input to institutional and policy change in the fields of education, ethics and gender. The programme was the key to driving critical change in national research agendas. As underlined by the ICF evaluation report, FP7 SiS also generated a “scaling up effect” meaning that marginal issues in national research agendas were prioritised and scaled up in terms of scope, available funding, and involvement of European and international project partners.

The evidence provided above illustrates the need to further involve Member States and key stakeholders with the twofold objective of improving the effectiveness of the programme and its value for participating institutions.

What wider impacts have been generated by projects or clusters of projects (e.g. on EU thematic policies like Environment, Health, Transport, Agriculture, etc.), on international (global) policy and dialogue, on stakeholders, on research and innovation practices? What are the extent of the impact and its relevance?

In order to measure the EU added value, an important aspect is whether the results of the SxS projects had wider impacts on international policy debates, including their influence on policy makers and research communities. Several experts and SxS project participants interviewed identified impacts which went beyond those expected, also at the international level, including:

- **Impacts on research and innovation practices**: Several projects influenced the research community, with publications stemming from SxS projects mentioned in several other studies (i.e. the results of the GENDERBASIC project influenced research in the biomedical research community; the Kenya Ministry of Medical Services requested a consultative meeting on capacity building in health research, which GenBenefit provided);
- **Contribution to the development of policies at both EU and international level**: The SxS programmes not only had an impact at national policy level, but also contributed to shaping the international policy debate. Some noticeable examples were:
    - The R&DIALOGUE project was used at EU level by the European Economic and Social Committee in setting up the European Energy Dialogue;
    - The FAAN project had an impact on the EU policy debate on sustainable consumption and provision of food. The project coordinator was invited to Korea to share information about the "Local Food System";
    - Two Co-Chairs of the UN Convention on Biological Diversity (CBD) Working Group on Access and Benefit Sharing attended several GenBenefit meetings and noted that this helped them understand the difficulties for indigenous communities in protecting their traditional knowledge;
    - The Robolow project contributed to debate about robotics regulations. The results of the project were presented to the JURI Committee of the European Parliament;
    - The ECOST project contributed to fisheries policies and had an impact on the European strategy related to biodiversity in Asian and Caribbean countries; the Meadow project was quoted and implemented in different organisations such as the World Bank or the OECD;
- **Initiation of debate** on emerging topics or development of an international policy dialogue. Some interviewees reported having contributed to the international debate on a specific area or even having supported the creation of an emerging debate on new topics (e.g. due to dissemination activities, the PACITA project helped to open up new

themes in the research community such as the theme of active ageing and telecare);

- **Creation of long-lasting communities of practice** (i.e. the STAGES consortium partners built a Network of women in science and a Centre for Gender Equality in Science) or further development of the project results through new projects (i.e. the results of the FEMSTART project were further developed in the FEMENADE project);
- **Implementation of the results of a project by citizens/CSOs** and use for training purposes. The PERARES project results were used by those willing to open Science Shops. The European Commission exploited the RRI Tools training programme for their own internal use; the e-learning DVD of the ETHICSCHOOL project was used by the recipients for personal training.

While there are examples of projects that led to a significant debate on an international level, an independent expert considered that the contribution of EU projects was not as high as they could be. These topics require a continuous and long-term commitment to inducing societal change while the majority of SxS projects do not have a follow-up. In order to increase the effectiveness of the Science/Society "strategy" of the Commission, a stronger commitment is needed by Member States.[100]

How do SaS/SiS activities and other relevant historical activities compare (benchmark) to activities carried out by enterprises and foundations?

Over the years, the interaction between the world of science and wider society has raised growing interest. Many entities have started researching on related topics either carrying out single activities or within more strategic programmes. Those included institutions from both the public and the private sector active at national, regional and international levels. Grouped by type and focus, it is possible to distinguish:

- **International organisations with global membership active in broad science/society topics.** UNESCO, for instance, examined the impact of scientific change on society and its governance. Together with the International Council for Science (ICSU)[101] - a non-governmental organisation including national scientific bodies and international scientific unions - it organised the first World Conference on Science (Budapest, June 1999) to discuss major science and related societal issues. The participating 1,800 science stakeholders from 155 countries (including policy makers), agreed on a set of principles and guidelines to shape the course of science, research and science/society relationships in the Twenty-First Century and issued two Declarations.[102] A series of associated Meetings organised around the world proved the strong commitment to promoting a multidisciplinary and holistic approach to research able to integrate societal concerns. An international code of

[100] The interviewed expert makes the example of the OECD PISA Test which has had a strong impact in structuring the Italian educational system which has adopted this type of evaluation. On the contrary, the education and science debate stemming from EU projects has had a very little impact. The expert continues suggesting a stronger relationship between the technical offices of the MS (e.g. the ministries) and the EC.

[101] http://www.icsu.org/

[102] 'Declaration on Science and the Use of Scientific Knowledge' and 'Science Agenda: Framework for Action,' known as the Declaration and Framework respectively (UNESCO, 1999).

ethical conduct for scientists was also suggested to ensure that science was directed towards the benefit of the general public.

- **International organisations with specific focus. The type of activity varies depending on the theme.** Many organisations focused on women in science and in general STEM with the objective of empowering them. The Organisation for Women in Science for the Developing World (OWSD),[103] for instance, unites female scientists from the developing and developed world in order to strengthen their role in the development process and in leading positions. The OWSD provides research training and networking opportunities for female scientists throughout their careers and organises international conferences. In the field of ethics, the Council for International Organisations of Medical Sciences (CIOMS) in collaboration with the World Health Organisation (WHO) issued International ethical guidelines in relation to biomedical research involving human subjects.
- **Foundations promoting an improved governance of science issues across the countries.** Activities carried out by Foundations usually involve policy makers and aim to establish links with EU Institutions to advocate societal needs and aspirations. The Open Society Foundations (OSF), for instance, implement initiatives to ensure the rule of law and the respect of fundamental human rights in all societies. In the European Union, the Open Society launched an initiative to build accountable and legitimate democracies which encourage the active participation of individuals and CSOs in policy debates and policy-making processes. It does so by providing evidence to policy makers, networking with EU institutions and Member States, as well as by establishing links with NGOs and activists. Some areas of intervention include: media, information, youth and education. In line with the SaS/SiS programme, the OSF carried out activities to provide the public with free access to scientific research results in order to make knowledge a real public asset. A relevant result was the launch of the open access movement[104] at the end of 2001. The movement issued recommendations on policy, licensing, infrastructures, advocacy, and coordination. Another renowned foundation which operates at global level is the Bill and Melinda Gates Foundation.[105] The areas of competence include global development, education, science and technology with a specific focus on developing countries. The approach adopted usually consists of establishing collaborations with partners in order to tackle global challenges, also taking into account the situation at a local level. The foundation is committed to fostering strategic alliances with governments and the public and private entities, with the aim of generating a greater public awareness of emerging global issues. Ethical, social, and cultural considerations are embedded in all of the foundation’s activities. A specific Ethical, Social, and Cultural (ESC) programme, originally established to support the Global Health Division, works across the sectors to ensure that cultural barriers and societal concerns are addressed.

[103] Formerly it was known as the Third World Organisation for Women in Science or TWOWS. Further information available at http://owsd.ictp.it/

[104] http://www.budapestopenaccessinitiative.org/boai-10-recommendations .

[105] See more at: http://www.gatesfoundation.org/.

- **Enterprises concerned with science/society issues.** The position and role of science in knowledge-based societies has required closer interaction between private and public research, including universities and other public research institutions. Enhanced links between market actors and the research community are expected to scale up research impacts and provide policy makers with new and sound information. Traditionally, enterprises have shown some distinguishing features regarding research objectives and scope. Generally, they have a focused and narrower research agenda with short-term and profit-oriented research objectives. Therefore, companies have usually carried out targeted activities limited by competition rules and framed in wider strategic planning. In recent years, the business perspective has been enriched by new interests which are different from but compatible with the logic of competitiveness and profitability. The concept of corporate social responsibility (CSR) has brought new concerns related to sustainability, the wellbeing of employees, community and civil society in the enterprise culture. The underlying reason is that enterprises do not operate in isolation but within complex socio-economic contexts. Thus, businesses should be respectful and accountable not only to shareholders and investors but also to stakeholders and citizens. Regarding science/society issues, corporate attention and investment greatly varies depending on the size of the company and on the interest driving the expenditure of sustainability budgets. Some of the world's largest businesses are spending high percentages of their budgets on child education and teacher training activities in STEM. IBM, for instance, has initiated a programme -KidSmart early learning[106] in partnership with the United Way, the Bank Street College of Education and the Center for Children and Technology, to help children (aged three to seven) become familiar with technology across the world. The initiative has been reported as successful especially among children and teachers from disadvantaged countries.[107] To solve the problem of a skills gaps in the US job market, IBM has developed the P-TECH 9-14 model which brings an innovative approach to public school teaching, combining college classes and hands-on experience (e.g. mentoring, internships).[108] Other programmes focus on teacher training to promote student interest in science, technology, engineering and maths (e.g. Teachers TryScience).[109] Similarly, Microsoft has launched Microsoft YouthSpark, a global and cross-company initiative, to allow access to computer science for more than 300 million children. Through the DigiGirlz programme,[110] special attention is paid to middle and high school girls with the objective of illustrating possible careers in technology. In fact, companies gradually understand that optimising female participation in STI does not mirror a civic obligation for equality but is simply a matter of good governance with high a potential impact on businesses. L'Oreal's Women in Science Programme,[111] for instance, aims to support talented female researchers and to encourage more young women to enter the profession by providing career advice and assistance.

[106] See more at http://www.ibm.com/ibm/responsibility/initiatives.html
[107] https://www.ibm.com/ibm/responsibility/downloads/initiatives/COF03015USEN-KidSmart.PDF
[108] http://www.ptech.org/
[109] http://www.teacherstryscience.org/
[110] https://www.microsoft.com/en-us/diversity/programs/digigirlz/default.aspx
[111] http://www.forwomeninscience.com/en/home

5 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

5.1.1 Evaluation at project level

RELEVANCE

The study shows that SxS projects were relevant to the objectives of the programme's action lines on the six dimensions of analysis. In most SiS project proposals, but less than half of SaS project proposals, project coordinators and participants tried to explicitly link their project activities to the SiS programme objectives - especially at topic level - to highlight the relevance of their projects to the Commission's strategy in the science/society domain. However, there were few links to the Action Line or Activity Line objectives. Instead, they appeared to have general knowledge of the main programme objectives and a more solid awareness about the specific objectives of the Work Programme Topics (Conclusion 1).

The analysis also shows a relatively low degree of awareness of other EU policies (SaS Action Plan, Innovation Union and ERA). A small share of project coordinators and participants considered their projects as having contributed to these policies and only a limited number of project proposals explicitly linked the project activities to these policies. However, the overall coherence between call topic objectives and EU research policies and programmes ensured that even if project coordinators mainly focused on the specific objectives and expected impacts at Topic level of the Work Programmes, the activities of each project were, de facto, contributing to the overall objectives of the top-level strategies (Conclusion 2).

EFFECTIVENESS

The large majority of both SaS and SiS projects achieved their objectives.

However, due to some organisational issues, not all objectives were fully attained. Organisational issues included: (i) difficulties in terms of appropriately managing the time and resources allocated to the projects; (ii) difficulties in engaging the targeted stakeholders or policy makers; and (iii) challenges in communicating with other consortium members (i.e. difficulties in the management of large consortia in different geographical locations). The significant increase in the SiS programme budget in comparison to SaS resulted in higher than average SIS project budgets and a larger number of participating organisations in each project. The resulting operational challenges, reported by larger and more diverse consortia, were usually managed with greater-than-expected efforts by project coordinators (Conclusion 3).

The dissemination of project results is a particularly significant aspect for SxS projects. A comparison between the dissemination actions planned in the project proposals and the actual implemented activities shows positive results: 83% of the analysed projects reported full achievement of the planned activities (Conclusion 4).

A key success factor to achieve such results is networking between project partners. For example, partnerships with international organisations and other projects provided access to potentially interested audiences to disseminate the information about project events and results through the appropriate channels (Conclusion 5).

In terms of effectiveness in contributing to the programme objectives, the study found that the SaS and SiS project achievements were overall in line with the objectives outlined at activity line/programme level. More specifically:

- Projects related to the "**gender and science"** dimension under FP6 contributed to stimulating female participation in science and technological development as well as raising public awareness of gender issues in scientific research. The projects related to this dimension under FP7 contributed to boosting gender mainstreaming in institutions and, to a lower extent, fostering the integration of gender issues in research
- Under FP6, the SaS programme did not have a specific activity dedicated to the issue of "**open access"**; projects identified as anticipating these topics mainly focused on activities of knowledge dissemination. It is only possible to identify projects which encouraged debate on information dissemination and improved access to research for the public under the SiS programme;
- **"Science literacy"** projects under SaS contributed to the promotion of young people's interest in science, while also increasing public awareness of scientific advances and their impacts. Under the SiS programme, Science Literacy projects contributed to the objective of increasing the number of youth pursuing careers in science while also maintaining past objectives of increasing awareness;
- The "**science and ethics"** achievements of projects under both SaS and SiS programmes contributed to greater commitment to the active and ethically responsible governance of science. "Science and Ethics" projects experienced a shift of focus, moving from the generation of new knowledge in the ethics field in SaS to identifying more practical solutions to address ethical issues in SiS;
- Projects related to "**governance and scientific advice"** contributed to strengthening links between policy makers, researchers and societal actors. In addition, under the SiS programme, these projects contributed to the mainstreaming of responsible research and innovation;
- Both SaS and SiS projects related to "**civil society and citizen participation"** contributed to promoting dialogue between society and research by performing cooperative research or by building networks between local actors that act as intermediaries between the general public and researchers (such as bodies involved in the organisation of science events).

BEST PRACTICE

The study identified some projects that were able to contribute significantly to the evolution of their paradigm of reference. Although not always path breaking, in most cases projects introduced a certain degree of innovation in their respective fields and applied new approaches to stakeholder involvement or developing new tools.

The most frequent types of innovation brought by the SaS and SiS projects was in terms of (i) the involvement of new types of stakeholders; (ii) the composition of partnerships in the consortia with organisations that were never included before; and (iii) the adoption of new means of dissemination, with increased use of social media and websites through appropriate support (videos, broadcasts or on-line applications).

The most innovative projects were those related to the science literacy dimension. For instance, those projects which developed new training methodologies, implemented e-learning solutions in new contexts or developed collaborative learning approaches (Conclusion 6).

5.1.2 Evaluation at programme level

EVOLUTION OF THE PROGRAMME

The programmes evolved over time, to a small extent during the implementation of each programme (i.e. changes in the Work Programmes) up to a larger extent in the transition from SaS to SiS. The grounding dimensions ("gender and science", "civil society and citizen participation", "science and ethics", "governance and scientific advice", and "science literacy") are common to both programmes, with the addition of the open access dimension under SiS. This ensured a continuity of the strategy of the programme although some objectives changed focus during the transition (Conclusion 7).

The study identified common themes that spanned across programmes and themes that faded out. New research topics were added through time. The most significant evolutions include:

- The SiS programme emphasised activities related to the involvement of the civil society in research and regarding the governance of science;
- In both programmes, the most relevant dimensions were "science literacy" and "gender and science". However, the SiS programme scaled up the objectives by increasing science communication aimed at creating a widespread scientific culture and tackling institutional settings hampering a full gender equality in research;
- The "Science and Ethics" dimension incurred the highest discontinuity going from the SaS programme to SiS. The common pattern remained the creation of networks of experts and the organisation of events with a focus on the relationship between science and ethics.
- A matching analysis between the SaS and the SiS topics has shown that only a few SaS topics were discontinued under SiS. In addition, several SaS topics were further developed in SiS creating a higher number of areas of intervention. This means that, although the available budget under the SiS programme was significantly higher, the fragmentation of the intervention increased as well (Conclusion 8).

This evolution of the programmes was due to several contributing forces. The evolution of the content and structure of the Work Programmes (in terms of activities and thematic areas) reflected on the emerging ethical, legal and social issues in science and research activities in the ERA. In addition, the SiS programme largely adopted the recommendations of previous evaluations of the SaS programme. One relevant improvement is the SiS programme's more structured approach towards fostering systematic collaboration between research organisations, civil society and policy makers in science and research through MML instruments and RRI. However, some recommendations were not implemented. For example, despite the progress made in clarifying the objectives and in monitoring the implementation, FP7 SiS did not introduce pre-defined 'success indicators' to link the activities with high-level priorities and impacts (Conclusion 9).

PROGRAMME COVERAGE

The overall sum of the EC contribution to SiS projects was €288.5 million, a much larger budget considering that the SaS projects in total received €76.7 million. The higher budget was mainly distributed to two Action Lines: "A more dynamic governance of the science and society relationship" and "Strengthening potential, broadening horizons". The first action line included activities relating to aspects of science governance, science based policy making, ethics in research, and the engagement of societal actors; the second focused on themes like gender in science and scientific education.

By looking at the distribution of the funding by dimension – considering that each RRI dimension is comprised of similar/related programme objectives – the most funded dimension is "science literacy" with a total budget exceeding €128 million for the SaS and SiS programmes combined. Under the SiS programme, the budget increased in all dimensions (especially for activities related to "governance and scientific advice" and "civil society and citizen participation") with the exception of "Science and Ethics". The overall budget did not change going from SaS to SiS.

All thematic areas were covered under the SaS programme, and all but one SiS thematic areas had at least one funded project. Under both programmes, the most funded thematic areas supported projects aiming to support formal and informal science education in schools.

IMPACT OF THE PROGRAMME

The programme objectives are defined in generic terms (i.e. boost gender equality). Thus, measuring their achievement in quantitative terms was not feasible. In addition, the objectives of the SaS/SiS programmes were particularly ambitious in relation to the average funding per project; the programme activities and funding were insufficient to achieve the envisaged large-scale impact in the general programme objectives. The fragmentation of projects into multiple Action Lines and Thematic Areas also reduced the ability of groups of projects to have long-standing impacts (Conclusion 10).

Across all the dimensions, significant progress was made towards the achievement of programme objectives. However, there was no general consensus amongst experts on the achievements of SxS programme activities as some of them believe that results of the projects could be exploited more at EU level (in the gender dimension, for example)

The implementation of RRI policy was a great achievement of the SxS programmes regarding the "Governance and Scientific Advice" dimension, which not only influenced research conducted under the H2020 programme, but also influenced national research agendas.

Regarding the "science literacy" dimension, experts agreed that further developments needed to be made towards a "science-based society". Nonetheless, much progress was made in terms of (i) defining new and more effective methods to teach science in schools (although the uptake by national institutions is still low); and (ii) increasing public awareness on scientific advances thanks to the numerous events, conferences, contests, etc.

Regarding the achievements of the "civil society and citizen participation" dimension, there is a stronger overall dialogue between societal actors and research, with an increasing number of projects focusing on cooperative research. This trend is confirmed by figures on the composition of project consortia under both FP6 and FP7 that show a greater involvement of CSOs.

The study sought to identify wider impacts of the programmes under four aspects: (i) policy impact at EU, national or local level; (ii) Institutional impacts also on participating organisations; (iii) impact on social media; and (iv) scientific impact. More specifically:

- Although it was possible to identify some SaS-SiS projects that had an impact on EU and Member States policies in some thematic areas, the overall uptake by national policy makers and MS institutions seems to be quite limited (Conclusion 11);
- Several stakeholders reported a positive impact on their organisations, such as a higher awareness of issues relating to gender, science education and ethics. Most importantly, participating organisations managed to expand their networks which resulted, in some cases, in new opportunities in similar initiatives/projects and informal networking (Conclusion 12);
- The social media impact, in terms of magnitude of the echo generated around SaS/SiS issues, was low and limited to projects events. The main factor explaining the "social media performance" was the state of technology in the timeframe considered, along with the relevance of communication tools to the project implementation (Conclusion 13);
- Finally, the total number of scientific publications was higher for SiS than for SaS within all the thematic dimensions considered (193 publications for SiS and 150 for SaS). Looking at the quality of scientific publications in terms of the number of citations, the results are significantly different. On the whole, the average number of citations per publication is higher in SaS projects (9.2 citations per article versus 6.6 of SiS project publications). However, the lower average number of citations and a relatively modest number of SiS publications in comparison to SaS is largely due to the recent implementation and ending of several SiS projects and the fact that scientific articles are sometimes published sometime after a project ends.

TOOLS AND APPROACHES USED

In general, survey participants considered the funding instruments used under both SaS and SiS programmes as being very effective. Mainly in supporting the consortium to focus on the project objectives (84% of the respondents gave a positive assessment); the positive assessment slightly decreased regarding their ability to form the appropriate partnerships (71%) and to effectively involve the right stakeholders (65%).

A large majority (85%) of project participants and coordinators considered the Coordination and Support Actions (CSA) as the most effective funding instruments to create the appropriate partnerships. In addition, CSAs gave more possibilities to cover the costs that organisations usually cannot sustain. However, the inclusion of many partners from different Member States forced the coordinating organisation to focus on project management activities, thereby diverting efforts from research and dissemination (Conclusion 14).

In order to assess whether the approaches used for SaS/SiS programmes proved to be relevant to the objectives, the projects were ranked based on their impacts (e.g. policy, institutional, scientific). The ranking shows that there was no clear discernible pattern in terms of the different dimensions (e.g. "gender and science", "science and ethics"): at least one project for each dimension could be found in the top ten cases.

5.1.3 Evaluation at other policy levels

SaS/SiS horizontal activities coverage

A common view of interviewed stakeholders was that an increase in the cross-programme integration was visible going from FP6 to FP7. This was especially due to the implementation of the RRI policy in 2010 as a horizontal approach embedding the different dimensions of SxS programmes in EU-funded research projects.

However, although the RRI policy supported awareness of the science/society dimensions, most interviewed experts considered these aspects as being mostly treated as collateral to the projects and not central as they might be under the SxS programmes (Conclusion 15).

Going from the FP6 to the FP7 programme, the analysis of the monitoring reports showed a decrease in non-SiS projects that include the gender dimension in research content and implement Gender Equality Actions. On the contrary, interviewees reported that ethical issues in research gained importance under FP7 in comparison to the past, with an increased share of projects having gone through an ethical review. A greater engagement of societal actors was also demonstrated by the increase in the number of CSOs involved in research projects.

SaS/SiS horizontal activities integration

An evolutionary path can be drawn from FP4 to the ongoing Horizon 2020. Despite the lack of a specific programme dedicated to science/society topics, societal concerns emerging from the interrelations between science and technology were already present as cross-cutting issues in the research themes of the FPs. The socio-economic research conducted under FP4 took into consideration the wider impacts and aspects of all the research activities with the objective to strengthen the interface between science, research and society. Closer to the SaS/SiS programmes, FP5 integrated fundamental ethical principles in the funded research, the gender dimension and addressed specific ethical aspects.

Analysis of the research activities conducted under FP6 and FP7 shows that the SaS and SiS activities were distinct but complementary to research conducted by other specific programmes. There are some aspects that are common to other "Strengthening the ERA" and "Cooperation" programmes, in particular societal concerns related to ethical principles, gender aspects and democratic governance. However, no major topic overlap was identified.

SaS/SiS horizontal activities impacts

Overall, projects where SaS/SiS was implemented achieved their stated objectives to a fairly high degree with no marked differences from otherwise comparable projects in all of the relevant dimensions. However, survey respondents considered the SaS/SiS projects (vertical) as having achieved higher organisational and institutional impacts than the horizontal projects. Related projects tend to have lower policy impact but higher scientific impact in comparison to SxS projects (Conclusion 16).

As reported by interviewed experts and project participants, generally, SxS topics in other FP projects tend to remain marginal with respect to the core activities carried out. Thus, actual impact in relation to SxS objectives is less evident.

SaS/SiS impact at other levels

Interviews with national policy makers recognised that SxS projects contributed in some ways to the development of national policies, although with marked differences amongst countries.

In particular, the SaS and SiS programmes contributed to raising national attention and preparing the ground for national initiatives (i.e. stimulate "gender and science" policies in several countries; set a minimum standard for OA national strategies; encourage the use of non–conventional methods in science education; embed citizen participation in national policies).

A common opinion of the interviewed experts was that there are only a few policies at national level, in Europe, that are similar to the SxS programmes. Yet, the approach is different, as national initiatives are oriented towards the implementation at local/national level rather than focusing on general foundational issues (which is typical of SaS/SiS projects). Thus, projects funded by the EU were considered as being more important than national ones and as having a broader international perspective.

Interviewed experts considered EU research policies as being particularly advanced in comparison to national ones: for instance, in the field of open access, the EU is a "blueprint" for national interventions. In fact, most Member States do not have policies on open access and conflicts on copyrights and restrictions still cause implementation problems.

On an international level, the EU is considered to be a forerunner in most areas. For instance, in countries like the US and Japan, there is a lower uptake by national research agendas of issues related to open access and civil society engagement. However, experts in gender issues consider the research agenda on gender issues in the US as being more advanced than in Europe, mainly for historical reasons.

European added value of SaS/SiS

SaS/SiS projects demonstrated strong EU added value by achieving resource pooling, scaling up science-society topics in the national research agendas, enhancing the visibility and relevance of covered issues in the EU research community, and wider policy impacts at EU and international level.

Prior to SaS/SiS programmes, science-society issues were not broadly and uniformly addressed in national debates and agendas, as the focus was traditionally placed on 'hard' sciences and technologies. The implementation of SaS/SiS projects at the EU level proved that an EU-wide approach was essential to integrate science and society issues and to achieve economies of scale for high-quality research. The case studies show that the EU added value of SaS/SiS projects lies in delivering a common understanding of key concepts, EU-wide data/sources of information and sharing best practice to set up a common knowledge base and framework at EU level. Interviewees considered EU funding a key factor to overcome national institutional and financial barriers to the elaboration of national strategies and reforms, especially in newer or low-resource Member States. Thanks to SaS/SiS programmes, science-society topics gained visibility and relevance in the national research agendas.

The EU added value of SaS/SiS programmes can also be seen in the wider impacts achieved on:

- **EU thematic policy developments**. Some SxS project outcomes have provided inputs to EU strategies and policies by boosting knowledge circulation amongst institutions, policy makers, and societal actors and by supporting the policy debate on specific issues relevant to the society (e.g. EDIG, FAAN, GENBENEFIT, R&DIALOGUE, Robolow).
- **International policy and dialogue**. Some SxS projects have contributed to shaping the international policy debate on specific topics and to initiate dialogue on emerging topics through the dissemination of their results and approaches within the wider research community (e.g. PACITA).
- **Governance of R&I**. Some SxS project publications were referred to in other subsequent studies, thereby providing sources of information to the research community (i.e. GENDERBASIC).
- **Stakeholders and project participants**. SxS projects have strengthened the coordination between science organisations. Generally, participating scientists have reported gains in networking and research capacities including a more active role in policy making. Many project coordinators have reported improvements in their project management skills and in the understanding of societal implications of science following their SaS/SiS project involvement.

SaS/SiS and Horizon 2020

The general perception amongst stakeholders was that SxS activities contributed to the development of SwafS' contents and RRI issues in Horizon 2020 due to the progress made in ethical reviews, gender balance in research teams and open access. However, there is no sound evidence of any causal link.

The evolution of science-society issues from FP6 and FP7 to Horizon 2020 is characterised by the broadening focus in each thematic dimension due to the integration of new concepts and a stronger orientation towards innovation in society and research activities. The concept of RRI, seeking to embed the values, needs and expectations of European society in the R&I process, provides a new point of reference for many science-society issues. SwafS activities are organised in eight specific lines, six of which mirror SiS activity lines and related main objectives. The rationale is to better respond to the identified societal needs and aspirations in the new programme.

- In Horizon 2020, promoting gender equality is a key priority in RRI. SwafS introduced direct support to research organisations to implement Gender Equality Plans as "drivers" of systemic institutional changes (e.g. related to HR management, funding, decision making). This support aimed to address gender imbalances in decision-making processes and to strengthen the gender dimension in research programmes to help the ERA reach its full potential.
- The ethical dimension of research gains a broader space and relevance in SwafS Work Programmes. Activities support adherence to high standards in research integrity and training to reduce the heterogeneity of existing codes. A more practical approach is adopted to provide responses to specific ethical issues.
- SwafS adopts a systemic approach to multi-actor engagement connecting scientists, stakeholders and citizens in the "co-creation" of innovative

solutions, products and services for society sensitive design and sound knowledge for policy making.

- Horizon 2020 adopts a global approach to RRI issues, integrating global networks along with relevant stakeholders from academia, international organisations, businesses, NGOs, policy makers and research funders.

5.2 Recommendations

The table below reports recommendations in relation to the areas for improvement identified in the current study.

Table 15 - Recommendations

	Conclusions and area of improvement	Assessment and recommendations
RELEVANCE	**Conclusions:** • Good consistency between projects and programme objectives; • Low overall awareness of strategy by project participants; • Good coherence with other EC policies but with low project awareness. **Area for improvement:** Enhanced awareness may lead to more effective projects and a stronger coherence in groups of projects.	**Assessment:** The lack of awareness did not hinder the effectiveness of the programmes because only projects relevant to the specific call topics were selected. Moreover, the correlation between project objectives and programme objectives is part of the evaluation framework. However, this does not make participants sufficiently aware of top-level objectives and ensure long-term impacts. **Recommendations:** • Increase awareness through specific initiatives and involve the community of science/society experts in the development of the Commission’s strategy. • Include a requirement in the project proposal template for project participants to explain the coherence of project activities in relation to top-level Action Line objectives and other relevant EU policies.

	Conclusions and area of improvement	Assessment and recommendations
EFFECTIVENESS	**Conclusions:** • Organisational issues increased with larger projects, especially when involving many organisations from different countries; • Overall dissemination activities were effective but with some difficulties in reaching out all the targeted stakeholders; • Networking is a key success factor to reach the targeted audience. **Area for improvement:** Important to consider when smaller or larger project sizes are likely to be effective, particularly bearing in mind the organisational types likely to be involved and activities envisaged. Evaluation should take into greater consideration implementation and management aspects. Dissemination activities will continue to develop based on the changed (social) media landscape, likely requiring future attention to social media and science communication to build the evidence and practice base.	**Assessment:** Although most of the projects achieved their stated objectives, some reported difficulties regarding the use of available time, financial resources, and communication with internal and external stakeholders. **Recommendations:** • Strengthen the selection criteria favouring coordinators with stronger management skills *vis à vis* expertise in the call topics; • Promote the use of shared channels of communication between projects working on related topics (in so called " sister projects").
EVOLUTION	**Conclusions:** High level of continuity of topics from SaS to SiS with a further increase in the areas of intervention in almost all dimensions. **Area for improvement:** the increase in the overall budget in SiS corresponded to an increased number of areas of intervention and increased fragmentation of the SiS programme efforts. A more focused programme would support stronger impacts.	**Assessment:** continuity in topics for a long period supports enhanced impacts. Despite the increase in resources in SiS and the continuity in the areas of intervention, the increased fragmentation hampers the achievement of societal impacts that require a stronger and more focused intervention. **Recommendation:** • Reduce the scope of the activities financed under the programme and simplify the objectives. A small-steps approach may be more effective in the long term.

	Conclusions and area of improvement	Assessment and recommendations
PROGRAMME IMPACT	**Conclusions:** • Most expected impacts can be seen in terms of societal change and projects were evaluated only in terms of contribution to such expected impacts; • Low uptake of SxS outputs by national policy makers. **Area for improvement:** big steps forward are needed in the monitoring of science-society aspects in Europe and within individual projects: • Expected impacts should be specific and measurable; • Monitoring mechanisms should be able to cover when projects have ended, perhaps in synthetic and multi-project or initiative approach; • Projects should foster much closer collaboration with policy makers within actions, and implement evidence to policy transfers on a more systematic basis.	**Assessment:** the lack of KPIs (specific to SxS issues) to measure the long-term impact hampers a proper quantitative assessment of the programme impact. The low uptake of project outputs by local and national policy makers suggests that a stronger effort should be made by the Commission in facilitating the link between projects (group of projects) and policy makers. Recommendations: • Projects should be obliged to identify SMART KPIs regarding: (i) achievement of objectives; (ii) dissemination activities and outreach; (iii) expected impact on policy, social and institutional settings. In each dimension of analysis, the aspects to be monitored by project coordinators and the quantitative targets to be achieved should be determined. Moreover, the re-use of KPIs should be promoted. • Revise requested KPIs to make them specific to SxS objectivs (e.g. nr.of scientific publications is not relevant to SxS projects). • In order to address the low engagement of institutional stakeholders (i.e. policy makers), the selection criteria for projects should be strengthened in order to favour those proposals displaying a stronger commitment by institutional actors (policy makers). • Dissemination activities should be envisaged also at programme level. Aggregate results of groups of projects per thematic area should be presented, including toolkits targeting policy makers.

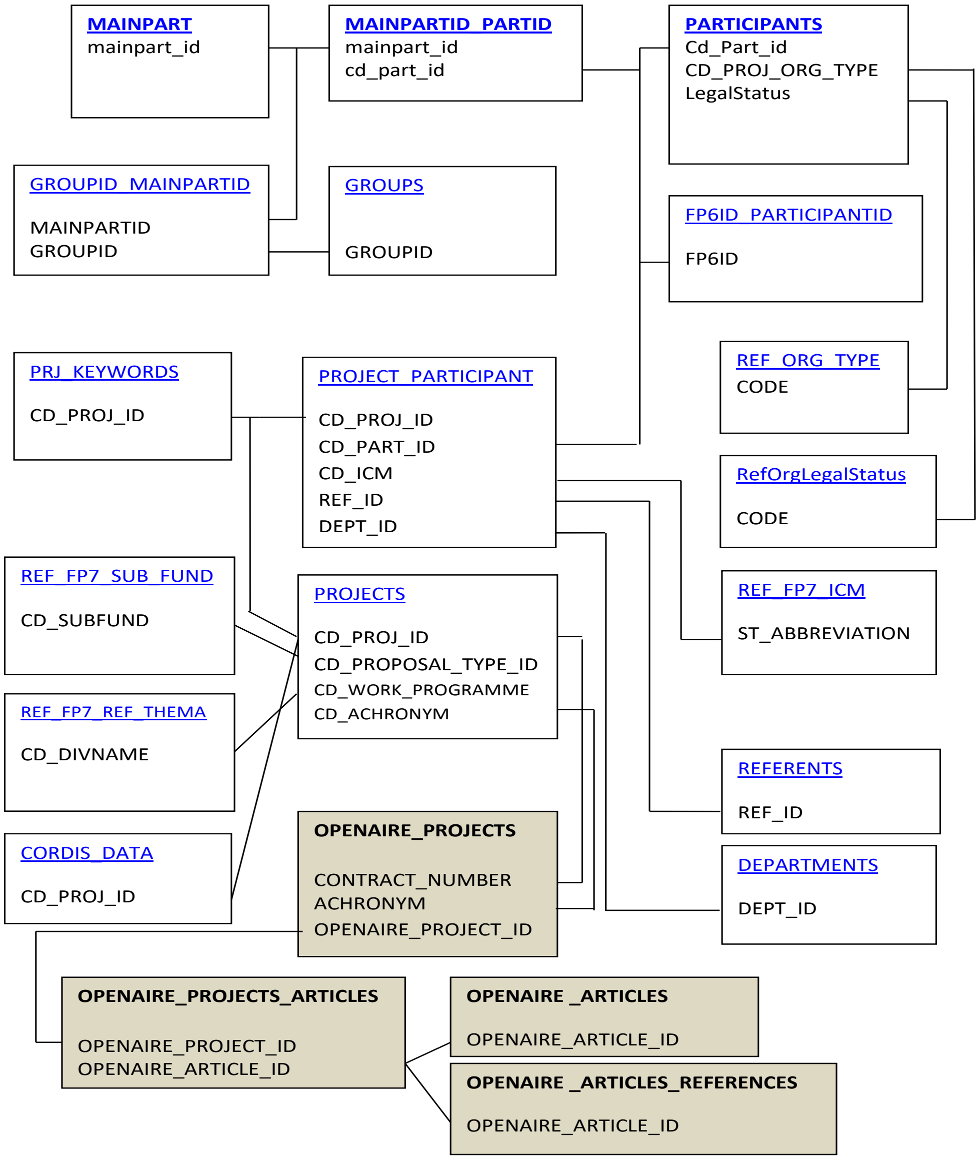
	Conclusions and area of improvement	Assessment and recommendations
PROGRAMME INTEGRATION	**Conclusions:** • SxS projects are not fully integrated with other parts of the Framework Programmes; • RRI policy has significantly contributed to spreading Science/Society issues across the FP programmes. However, such issues are only marginally embedded in FP projects; • "Fixing the knowledge" did not receive sufficient attention under SiS. **Area of improvement:** The integration of SxS projects with other parts of the FPs should be improved.	**Assessment:** An evaluation of the H2020 SwafS programme will demonstrate the extent to which SxS issues are embedded in other parts of H2020. However, the analysis undertaken shows there is a need to better integrate SxS dimensions in other parts of the FPs to strengthen institutional and policy impacts. **Recommendations:** • Promote gender analysis in research content in other parts of the FP. • Promote the integration of CSOs in projects other than SxS. Data show that (i) their participation in SxS projects is higher in comparison to other projects, and this trend increased in the passage from SaS to SiS, and (ii) their involvement would be relevant to develop the content of research towards more participative research which can be more responsive to the needs of citizens and reduce the gap between science and society.

Annex 1: Methodological Note

Structure of the relational dataset

The figure below provides a snapshot of the relational dataset used in the study.

Figure 29 - Entity relationship diagram



Source: Author's elaboration

Sampling strategy

The aim of this activity was to identify two samples of FP6 and FP7[112] projects that did not belong to SaS-SiS programmes but that were somehow related to

[112] For FP6, the research team has taken into account the projects belonging to Block 1 and Block 2,

SaS and SiS in terms of content and objectives ("SxS related projects"), and two samples of FP6 and FP7 projects that were not SaS-SiS related ("other projects"). To define the samples, the research team initially used the information contained in the title, information available in eCorda for both FP6 and FP7 projects, six main steps adding a final validation phase.

1 **Dictionary definition.** The title of each SaS-SiS project was reduced to a list of meaningful words (e.g. articles were deleted) and for each word, its root were identified (i.e. stemming)[113]. Some generic words were eliminated.

2 **Semantic distance calculation.** Using the list of words available for FP6 and FP7 projects, it was possible to calculate a semantic distance based on the number of words in common over the number of possible words (i.e. Jaccard distance). A matrix reporting the distance between any couple of each FP project was thus calculated.

3 **Set of relevant keywords.** Important SaS-SiS keywords were identified in order to distinguish FP projects that are SxS related from those that are not. This was done in two ways. Firstly, by looking at the above-mentioned distance in order to group SaS-SiS projects in clusters where the most representative words were identified (e.g. the most frequent ones), and secondly - and alternatively - by selecting the most representative words of SxS calls (e.g. the most frequent ones). The two methods give similar results, confirming the robustness of the result. The research team eventually chose the second method to select representative words because, different to a clustering method, it avoids any arbitrary choice. The following two clouds of words report the (stemmed) keywords selected for SaS and SiS. The magnitude of each word is proportional to its frequencies in a call.

Figure 30 - SaS selected keywords

Source: Authors' elaboration

Integrating and Strengthening ERA (4 933 projects). For FP7, the research team has taken into account only the FP7- COOPERATION (7 834 projects).

[113] The stemming step has been implemented in python using machine learning tools provided in the pattern-vector module. For more information, see www.clips.ua.ac.be/pages/pattern-vector.

Figure 31 - SiS selected keywords

Source: Authors' elaboration

4 **Identification of related and non-related SaS/SiS projects.** These selected words were used to identify a set of potential SaS/SiS-related projects amongst the rest of the FP6/FP7 projects. More specifically, the research team selected projects including at least two words from the list. This allowed the team to distinguish FP SxS related projects from non-FP related projects.

- For FP6, the research team identified 244 out of 4,933 projects as being related to SaS;
- For FP7, the research team identified 346 out of 7,834 projects as being related to SiS.

5 **Screening and selection of 60 projects**. The procedure described above implies a high share of false positives and a careful screening was necessary. Thus, once the set of projects was identified (see point 4), the research team ranked the SxS-related projects according to the minimal distance to some SaS-SiS projects. Then, starting from the closest, 60 projects were manually selected in order to eliminate false positives, by using additional information, such as the abstracts (available in Cordis). The following figures show, respectively for FP6 and FP7, the distribution by priority/theme of three sets of projects: the 60 projects selected amongst them related to SxS; those related to SxS; all FP projects.[114]

6 **Identification of "other projects".** The sample of "other projects" (non-SaS/SiS related) was selected taking into account the distribution of priorities/themes of SaS/SiS-related projects. For each priority/theme the research team randomly extracted the same number of projects as in the SaS/SiS-related sample.

Finally, the research team validated the choice of the selected 120 SxS-related projects using all the project documentation.

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[114] For FP6, the research team has taken into account the projects belonging to Block 1 and Block 2, Integrating and Strengthening ERA (4 933 projects). For FP7, the research team has taken into account only the FP7- COOPERATION (7 834 projects).

Case studies selection

The case study analysis focuses on a selected sample of projects. The objective was to assess in detail the impacts of SaS and SiS projects and to identify good practices. The case studies were used to investigate specific issues emerging from the initial desk analysis of the projects and to better understand the reasons behind the different results, and when visible, impacts.

The research team therefore selected 30 projects from each group of interest: SaS, SiS, SaS related and SiS related. The methodology followed to select the first two samples is partially different from the methodology adopted for the two others. This is because the criteria that define the two groups are different. SaS (165 projects) and SiS (184 projects) are the two starting populations, which represent the main focus of our analysis. Meanwhile, the SaS related and SiS related (both numbering 60 projects) represent the benchmark sample and are defined for their correspondence with the previous two. This latter criterion should also be taken into account in the definition of the subsample.

SaS and SiS project Case Study selection methodology

Each starting list of projects was partitioned across the six different dimensions common to SaS and SiS. For each group, the research team considered the distribution of the project size in terms of participants.

Figure 32 - Statistics of the selection methodology for the SaS/SiS case studies

Simple Statistics						
Variable	N	Mean	Std Dev	Median	Minimum	Maximum
size	165	6.29697	4.79485	6.00000	1.00000	24.00000
budget	165	478815	492112	359535	23291	4444500
budget_av	165	105440	108497	65043	6998	662670
country	165	4.55152	3.21848	4.00000	1.00000	17.00000
org	165	2.18182	1.01976	2.00000	1.00000	4.00000

Spearman Correlation Coefficients, N = 165 Prob > |r| under H0: Rho=0					
	size	budget	budget_av	country	org
size	1.00000	0.52616 <.0001	-0.46408 <.0001	0.93963 <.0001	0.72434 <.0001
budget	0.52616 <.0001	1.00000	0.44546 <.0001	0.54414 <.0001	0.31060 <.0001
budget_av	-0.46408 <.0001	0.44546 <.0001	1.00000	-0.39162 <.0001	-0.41873 <.0001
country	0.93963 <.0001	0.54414 <.0001	-0.39162 <.0001	1.00000	0.69638 <.0001
org	0.72434 <.0001	0.31060 <.0001	-0.41873 <.0001	0.69638 <.0001	1.00000

Source: Authors' elaboration

Before proceeding to the random extraction of the sample, the research team eliminated all the projects that had already been investigated in previous studies, namely "Ex-post Evaluation of Science in Society in FP7" by ICF and "Interim evaluation & assessment of future options for Science in Society Actions" by Technopolis. Moreover, the research team also took into account the availability of project documentation provided by the EU (i.e. trying to avoid including projects for which sufficient information was not available).

For each group, the research team randomly extracted a number of projects in order to maintain the same relative distribution across dimensions of the starting population. For each dimension, half of randomly extracted projects had a size below the median and half over the median.

SaS and SiS-related project case study selection methodology

The research team examined the distribution of the 60 projects across the thematic dimensions. Since there were some dimensions with very few projects (e.g. open access and open science), the research team decided to select all projects for these underrepresented dimensions. For the other dimensions where the research team had a sufficient initial number of projects, the research team followed the same methodology adopted for SaS and SiS (as explained above).

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ANNEX 3: CASE STUDIES

[Provided in a separate document]

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Summary:

This study assessed the implementation, results, and wider impacts of the "*Science and Society*" and "*Science in Society*" programmes, projects and activities in Framework Programme 6 and 7 (FP6 and FP7) – as well as their legacy in the development of '*Science with and for Society*' in Horizon 2020.

The study had two specific objectives:

- Take stock of the implementation, results and impacts of the SaS and SiS projects in FP6 and FP7, in order to update the existing studies and evaluation reports, and to create a solid evidence base for the analysis (stock-taking);
- Analyse in transversal manner the collected data and information to answer questions relating to multiple levels (i.e. programme, project and policy level) as well as to evaluate relevant horizontal issues (meta-analysis).

The findings and conclusions were presented to stakeholders and discussed during a final workshop in Brussels, which took place on 23 March 2017. Participants discussed future developments for science-society policy action under Horizon 2020 and FP9, and ways to increase the effectiveness of future actions. All of the study's findings and recommendations were validated by the participants, who also emphasised further areas for improvement including policy aspects.

Above all, the participants stressed the need to maintain a science-society programme in order to ensure continuity in the main topics and coordination with other EU programmes.

In the future, FP9 should establish links between science-society policies and regional innovation strategies developed by partner regions. This could also be done through platforms for discussion bringing together all projects funded under SwafS and other Horizon2020 pillars (e.g. excellence). Science-society policies should aim to involve the wider community, including civil society organisations and new entities (e.g. regions/municipalities), in workshops and consultations during the project life cycle. To a larger extent, projects should also branch out internationally and include global actors. As regards programme design, the participants underlined the need to ensure clarity of scope, objectives, and criteria in future calls for funding, as well as rules for participation that facilitate the involvement of small entities that may be closer to citizens and society. In order to achieve wider impacts at national, regional and local levels, participants suggested putting greater focus on the sustainability of the funded actions beyond the lifetime of funding and introducing Key Performance Indicators for the programme and its individual projects.