MID-TERM ASSESSMENT OF SCIENCE AND SOCIETY ACTIVITIES 2002-2006

Final report
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Foreword by the chairperson

The European Commission set up a panel with the mandate to undertake a Mid-Term Assessment exercise of Science and Society activities during FP6. As the Chairperson of this panel, I am pleased to preface this report of our analysis and deliberations on the various activities that were implemented through indirect actions under the Specific Programme "Structuring the European Research Area" in the context of FP6 as well as other associate activities. The main objective of our assessment was to evaluate whether the "Science and Society" programme activities are meeting the stated goals and objectives by reviewing several representative actions across the themes of the programme and analysing the potential impact of existing results on both European policies and on related activities supported by the European Commission and European States.

In 2001, the Commission undertook for the first time an important initiative with the publication of its *Science and Society Action Plan (SASAP)* ([1]) for addressing issues which are at the core to a new relationship between research activities and the society. There are many reasons that justify activities at European level in this domain: The increasing dependence of economic development on science and technology, the ever more elaborate complexities involved in developing and implementing research policies in association with a diversified population of scientists as well as the complexities of justifying these policies to the public and engaging citizens in thoughtful participation in processes of identifying social priorities and constraints are some of these reasons. One of the challenges in our task was to assess the Science and Society programme, as an innovation in the Framework Programme. Our task was further complicated by the fact that our evaluation exercise is a "mid-term" assessment which means that the majority of the actions supported in FP6 have not yet reached their full term and the results are not yet fully formulated.

We performed our work in two steps. At the first stage, a panel of five experts has reviewed and assessed a set of selected Science and Society activities, for the five thematic areas of the programme, and evaluated their potential impact on future policy development. The outcome of this part of the exercise was a series of review reports, one for each thematic area. The majority of the projects that were reviewed, in this first stage, were chosen by the Commission Services and we have assumed that this selection was representative of the activities of the programme which we had to assess. The panel did have access to all the available documents and project outcomes at request. In the next phase a second panel of six experts (the impact assessment

[1] European Commission, *Science and Society Action Plan*, Office for Official Publications of European Communities, Luxembourg, 2002

panel) has integrated the review reports of the first level with findings of other evaluation efforts performed by the Commission and, additionally, has taken into consideration other activities, such as conferences and forums organized in FP6. This second panel also drafted a series of recommendations for future Science and Society activities as well as further policy development in this area. In order to better co-ordinate our efforts and also safeguard a more comprehensive report, the two panels had two joint meetings.

I wish to acknowledge the very important and time demanding work performed by my colleagues of both panels; their insights and expertise were of great value in our efforts to achieve this collective and challenging task. This report and its conclusions are the entire responsibility of the “assessment panel” but thanks to the dialogue between the two panels we have been able, I think, to reach balanced conclusions. The rapporteurs, Costas Constantinou and Hana Havelkova, had the enormous task of integrating all contributions by bringing coherence to our analysis and views. I am very grateful to them. I also wish to thank the Commission and in particular Dimitri Corpakis, Dionysia Lagiou and Rafal Rowinski who have openly provided us all the documents and information that were necessary to perform our tasks; their competence and permanent availability were most valuable to our work

We hope that our report and our recommendations will be of value for the future development of this extremely valuable programme. We hope that in future the programme will continue to address challenging issues and that the various initiatives that take place at all levels of European society will help to raise the profile of science and technology and also broaden the constituency for thoughtful and informed scientific research targeted to meet the short and long term priorities of our societies in Europe.

Executive summary

At European level, “Science and Society” is a new initiative that was undertaken under Sixth Framework Programme. Its main objectives were formulated in the Science and Society Action Plan, which led to a broad range of activities numbering about 150 projects, conferences and forums. The programme is organized into five thematic areas: (a) Science Education; (b) Scientific Advice and Governance; (c) Ethics; (d) Women and Science; (e) Science Communication.

The programme attracted a large number of participants: 916 partners from the EU25 were engaged in projects with 764 (73% out of total of 1045 participants) from the EU15. The participants were predominantly from the public sector with higher education institutions (41%) and research institutes (23%) holding the largest share; participation from the industrial sector (public and private) has been rather modest ranging from 0.5% to 6% across the five thematic areas. The distribution of partners among countries has been rather even and those from new Member States have been rather fairly represented (with the exception of some areas such as governance) although the funding for their participation in the projects appears to be determined more commonly by the perceived cost of labour in these countries rather than the work involved.

The total funding for the Science and Society programme in FP6 was 71.5 M€. This was distributed among the five thematic areas of the programme: Science Education (including Scientific Culture and Descartes prizes): 24.3 M€ (34.1%); Science Communication: 5.3 M€ (7.4%); Scientific Advice and Governance: 4.7 M€ (6.6%); Ethics: 24.9 M€ (34.9%); Women and Science: 12.1 M€ (17%). In terms of funding, Ethics, Education (but including substantial funding for the Descartes prize) and Women and Science have received a relative priority. The types of funding instruments used were fairly evenly distributed. Coordinated actions represented 24% of the funding of activities, specific support actions 56% and specific targeted research 20%. For the vast majority of projects, the funding was at a relatively modest level (below 0.5M€).

We have considered that the activities of the programme are in line with the main objectives, as defined by the Action Plan and all the activities have contributed to its implementation. According to our evaluation, the main achievements of the programme are the following:

- The programme has established a forum and a context at European level for examinining Science and Society issues in a manner that provides reflective activities on specific issues related to scientific and technological research (such as Ethics, Governance and Science Communication). It has also developed a thoughtful scientific approach to highlighting and addressing barriers and future obstacles to the continuing contribution of science in society (such

as the challenge of safeguarding a sufficient supply of competent future scientists and engineers and the need to enhance the involvement of women in science).

- The programme has made important contributions in enlarging the circle of communities involved in such kind of activities at national level (with the biggest impact made in new EU Member States) and has provided increased visibility for these activities both among scientists and among the public.

- The projects have generally succeeded in creating networks of partners who have been able to achieve common goals, to exchange and share experiences and to demonstrate an European added value by contributing to the emergence of communities in Europe that are seeking to address issues related to the complex roles of science in society; this must be considered as being the main impact of the programme.

- Conferences and forums were able to launch debates in several areas (scientific culture, women and science in particular) at European level with a rather large participation from a diversity of actors. They have doubtless contributed to enhance the visibility in Europe of important issues in areas such as ethics, women and science and scientific communication and have also provided pilot examples of methodologies for how to achieve this in a broader spectrum of issues.

The Descartes prizes have also made a significant contribution in highlighting the importance of (a) European cooperation to achieve excellence in research and (b) science communication activities.

- Several projects involved non-European partners (for example, African countries in the Ethics theme) which has provided a valuable international dimension to the programme and has laid the foundations for more intensive future collaboration efforts with potential for enormous impact. This dimension opens new opportunities for the development of European capacity to work with local structures in developing countries in order to enhance European influence and international presence. Activities in this direction have the added advantage of providing a mechanism for obtaining the feedback that is so valuable in enterprises such as the pharmaceutical industry, the medical system or the food innovation mechanisms.

- The Commission services have acted in a commendably open manner in implementing the Science and Society programme. The Advisory Board, the Expert Groups and the various studies that were undertaken have provided valuable input in designing a policy and also modifying it along the way in the light of both new information and the response from the various actors.

Our analysis has also identified a certain number of weaknesses in the implementation of the programme:

- The scope of several projects, and possibly of the work programme, was too narrowly defined. This was particularly the case for the themes related to Scientific Advice and Governance, Scientific Culture, Ethics, and Women and Science). The worse situation was in the case of scientific culture which was addressed in the work programme only through the science education and science communication themes, an approach which has led to a very narrow focus of the overall approach. Furthermore very few, if any, of the projects were able to address "transversal" issues (such as ethics and governance or gender issues in science education).

- The participants were predominantly drawn from academics with actors from industry, public administration, the media, NGO's and, in general, policy-makers playing a more minor role.

- Many projects have considered the dissemination of their results and findings as a secondary activity: this is a serious handicap for the overall impact of the programme.

- The coordination with national activities in the Science and Society domain has not been achieved to any noticeable extent. The Open Method of Coordination (OMC) has not brought significant progress in this direction, partly because the CREST committee ([2]) has not played a proactive role in this perspective. There is also an issue with the problematic levels of commitment to relevant policy development in the home institutions by the various actors that take part in OMC activities. The Science and Society Programme Committee has also not taken sufficient initiative in this respect and the National and other Funding Agencies have, in the best of cases, taken only a very fragmentary approach to policy development and implementation on these issues.

We propose the following recommendations for a renewed "Science *in* Society" programme in the context of FP7:

- The perspectives of the programme could benefit from being broadened in two ways. First, it would be useful to correct for instances where the programme focused its objectives or activities too narrowly (Science Communication and Scientific Advice and Governance, respectively). Second, there is a need to include new topics, such as actions addressing "transversal" issues and social science research activities that would strengthen the knowledge base that is deemed necessary for the actions.

[2] CREST was a consultation body made up by MS themselves which was consulted whenever the EC came up with major proposals on science policy, including the SASAP. It reports both to the Commission and the Council.

- More intensive activity needs to be undertaken in the area of Scientific Culture in order to (a) develop a better understanding of the role which science should play as an important part of human culture; (b) envisage new channels for a better dialogue between scientists and the public, which should involve enhanced innovation in engaging a diversity of actors, including the public, in science-related debate; (c) promote innovative methods for the public accountability of science, including its ideas, its methods and the quality of its outcomes, and (d) demonstrate more effective approaches to better integrate Science into publicly visible creative culture.

- The diversity of partners involved in the various activities should be broadened so as to include academics, representatives of private companies, NGO's and, whenever possible, policy-makers in the public sphere (administrations, parliaments, etc.), as well as the private sector (industry and services) and the media. There is also room for the direct and indirect involvement of the other DG research and other EC directorates in several Science *in* Society activities during FP7.

- A greater effort should be devoted to the improvement of the dissemination of the outcomes of the programme, including the results and findings of individual projects. There is room for improved support by the Commission Services in specifying more effective dissemination strategies. There is also a strong need for follow-up activities undertaken by the Commission, in cooperation with the partners, in order to organize targeted dissemination of the achievements of projects.

- There is a strong need for coordination with national and localized activities in the various areas of the programme. In this perspective, the role of the CREST committee should be reappraised and new mechanisms need to be found in order to safeguard increased commitment to relevant home policy development by the actors that are involved in the various co-ordination activities. Greater effort needs to be devoted in engaging national funding agencies and policy-making institutions in an effort to achieve planned complementarity and greater coherence with the future Science in Society programme. A renewed emphasis on developing participative methodologies and specific indicators would also be of benefit in this respect.

- There is a need to re-examine the criteria that are applied for the evaluation of proposals. Criteria should include among others (quality being of course the primary one): (a) a detailed plan for dissemination of results and findings with a description of specific means; (b) the European added value of a project and its contribution to the emergence of a community dealing with specific science and society issues.

- The production of specific indicators would also be useful for future assessment of the sustainability and long-term impact of funded science and society activities.

- The European Commission should more actively encourage an internationalization of its Science and Society activity. On the one hand, on issues such as Science Education or Scientific

Advice there is room for productive exchange of expertise and experiential insight with Canada and the US who share similar concerns and have parallel extensive ongoing activities. Even more importantly, Europe has international interests and a mission that can only be realized through building new capacities to work with developing countries in Africa and the Middle East. The exceptional projects that have tried activities in science ethics demonstrate the enormous potential to work with and influence local structures (under admittedly many difficulties and severe constraints) but also to obtain experience with innovative applications in a diversified context. This, in turn, provides extremely valuable feedback to policy-making with respect to, for instance, the medical profession, the pharmaceutical industry, the food sector and water engineering. The Science and Society programme can take a pioneering role within the FP7 in developing this capacity to build a European competitive edge in developing countries while at the same time exploring new ethical and policy–related issues.

The first “Science and Society” programme at European level has demonstrated that a reflective approach with a robust scientific knowledge base is important for both science and society.

It provides the science enterprise with the thoughtful monitoring of the issues that may serve to constrain its anticipated impact but also with a proactive stance at broadening the constituency for science. It provides the society with methodologies for a thoughtful informative input to science policy development and increased opportunities to engage with authentic debate on issues of scientific concern. The positive achievements of the first “Science and Society” programme during FP6 clearly demonstrate that a renewed “Science *in* Society” programme with a broader scope would continue to contribute an important European vision to the construction of a new relationship between science and society with the collaboration of partners beyond European shores.

1. Introduction

A new context for the relationship between Science and Society, the need for a dedicated programme

Scientific explorations and technological innovations have deeply transformed our societies since the beginning of the 20th century by bringing us a new vision of the world and also changes to our economic systems and to our living and working conditions. Science has become both pervasive and increasingly specialized, while at the same time the mechanisms for production of knowledge have themselves been transformed: scientific and technological research has become an activity distributed among a large diversity of public and private institutions which, since the 1950s, have progressively acquired an elaborate European dimension. After several decades of an almost continuous progress on the various research fronts, one must observe, with Helga Nowotny (president of EURAB) that "science has become so pervasive, seemingly so central to the generation of wealth and well-being, that the production of knowledge has become, even more than in the past, a social activity, both highly distributed and radically reflexive. Science has had to come to terms with the consequences of its own success, both potentialities and limitations"([3]). Furthermore, science can no longer be considered as an autonomous space, since it is deeply embedded in the society and more largely in the world of politics. Following the recent developments in fields such as genetics and neurosciences, and the innovation of new technologies (in the information sciences, for example), the ethical dimension of science, its cost as well as its impact on everyday life have drawn attention from both the public opinion and political institutions and have been the focus of debates, since the 1990's, in Europe as well as in all developed regions of the world. The *Eurobarometers* which are designed to survey general issues regarding the relationship between science and society through public opinion polls, have been performed periodically by the European Commission since 1992; they have consistently revealed that broad sections of the public do care about scientific issues and have strong perceptions of their potential and existing impacts on life conditions. The public rejects the idea that technological progress could be imposed from the edges of society, by small fringe groups of actors, and it wishes to participate in having its say on the potential utilization of scientific discoveries. At the same time, a large fraction of the public opinion is requesting access to reliable information about scientific understandings on a very broad range of issues related, for instance, to public health, energy resources, food and materials, as well as the risk of ecosystem disturbances and natural disasters. This is a clear illustration of the fact that the relationship

[3] Nowotny, H., Scott, P., Gibbons, M., *Rethinking science*, Polity Press, ,Cambridge, 2001, p.1

between science and the society has progressively changed and that a new dialogue between the scientific community and the public is necessary as, at the same time, the *Eurobarometers* are revealing the existence in several countries of a gap between science and culture which has to be closed if science is to continue to receive support and suitably qualified personnel.

The European Commission and public authorities in several Member States have realized that a science policy for the 21st century in its European and national dimensions should rest on a new partnership between scientific research and the society. In January 2000, the EC published a memorandum, *Towards a European Research Area (ERA)* ([4]). In March 2000, a strategic goal was formulated in Lisbon: the EU should become by 2010 the most competitive "knowledge-based economy" in the world that should be based on the production and dissemination of scientific knowledge and be able to promote sustainable economic growth with robust social cohesion. The creation of the ERA was considered as being the cornerstone for the Lisbon strategy. It is in this context that, in November 2000, the Commission published a working paper *Science, Society and the Citizen in Europe*([5]),which set the basis for a debate on the relationship of science and technology with society and European citizens. Up to that stage the Science and Society concept had not been explored at European level.

In December 2001, a *Science and Society Action Plan* was presented at the request of the European Research Council unfolding the Commission's strategy for addressing the issues identified through the preceding debate.

The Action Plan aimed to bring together all efforts at European level in order to improve communication and to strengthen relationships between science and society and make them more harmonious. Three key policy attributes came together in the Action Plan: the Lisbon Agenda; the evolving creation of the ERA; and the implementation of the *White Paper on European Governance* ([6]) and the debate on the future of Europe. The Plan specified 38 individual Actions grouped into three priority areas or "Strategic Objectives". The first of these concerned the promotion of scientific education and culture involving a total of 21 of the specified Actions. The second was intended to bring matters of scientific policy closer to the citizens of Europe and involved 7 Actions. The third objective was intended to demonstrate responsible science being at the heart of policy-making in Europe. This involved 10 Actions. Each of these strategic objectives was in turn sub-divided into three subsets representing particular themes or "Policy Goals" to which the specific Actions were assigned. The first area comprised raising public awareness, enhancing science education and careers and improving dialogue with European citizens. The second concerned the involvement of civil society, gender

[4] COM (2000) 6 (see at: http://ec.europa.eu/research/era/pdf/com2000-6-en.pdf)
[5] SEC (2000) 1973 (see at http://ec.europa.eu/research/area/pdf/science-society-en.pdf)
[6] COM (2001) 428 Final (see at http://europa.eu.int/eur-lex/en/com/cnc/2001/com2001_0428en01.pdf)

equality issues, and research and foresight as related to society's concerns. The third involved the ethical dimension of science, risk issues, and the use of expertise in shaping policy.

It was recognised from the outset that the implementation of the Action Plan was a long-term aim, though clearly some of the Actions specified were individual events that could be undertaken on a short-term basis. It was also recognized that the type of objectives envisaged could only be achieved by involving Member States and that the Open Method of Coordination would be a valuable mechanism to fully achieve this. The Commission's role was to act as a catalyst for the many changes that needed to happen at all levels. To perform this role, it developed the Science and Society theme within the FP6 Specific Programme "Structuring the ERA", which was launched in 2002. The intention was to make use of the mechanism of FP6 and the various instruments within that in order to implement the guidelines of the SASAP and produce a "catalytic effect". The adoption of the SASAP coincided with the creation of a "Science and Society" Directorate in DG Research, which was given authority to manage the collaborative actions funded under the Science and Society programme in FP6.

The FP6 Science and Society theme did not entirely mimic the Action Plan itself because it was seen as important to retain some flexibility as part of a "bottom-up" approach for the research community. To start with the principal axes to the research programme were as follows: "Bringing Research Closer to Society"; "Responsible Research and the Application of Science and Technology"; "Stepping up the Science/Society Dialogue" and "Women and Science". In subsequent years, the main areas have been identified as: Scientific advice, governance and reference systems; Ethics in Science; Uncertainty, risk and the precautionary principle; Science and Technology Culture, Young People, Science Education and Careers; Prizes and Science Communication; Women and Science. The current organizational structure that guided this Mid-Term Assessment effort centres around five thematic areas: (a) Science Education; (b) Scientific Advice and Governance; (c) Ethics; (d) Women and Science; (e) Science Communication. It is important to note that the action areas involved in the research programme have been selected with the help of an Advisory Group that embraced a significant breadth of interests. The Group was also effective in facilitating a gradual evolution in priorities that reflected the feedback obtained from the level of response from the research community, through the quantity and quality of proposals.

It was realized, especially in the context of ERA, that significant results in connecting science with society would be forthcoming only if Member States themselves made an effort jointly with the Commission though maintaining diversity, as a means to better respond to local needs, priorities and potentials.

In this connection there is one further aspect that should be noted – namely the "Comité de Recherche Scientifique et Technique" (CREST).

There was regular discussion of the Action Plan in CREST where the Member States were fully involved. CREST developed a "Cluster initiative" after the Action Plan was published, which was regarded as a further implementation and coordination mechanism. As a result of Member States declaring their interests in the Science and Society agenda, eight Clusters were formed with particular themes led by certain EU Member and Associated States ([7]). As with the FP6 work programme, there was no absolute fit between the Cluster themes and the Action Plan. Indeed it was always intended that Cluster implementation by Member States would be flexible.

Hence, over these years, the realization of the Science and Society Action Plan depended on several institutions and mechanisms coming together: the Commission's use of the FP6 Science and Society work programme; the involvement and initiatives of the Member States themselves (in the spirit of the Open Method of Coordination) and, as an attribute of that involvement, the activities of the CREST Clusters ([8]).

One should stress that the EC clearly identified the needs for a Science and Society Action Plan and developed a funding programme, associate activities and an elaborate, participative policy-making structure to implement its objectives. One may also observe that in 2001 the level of national activities in relationship with Science and Society issues was uneven among the then 15 EU Member States: there existed in several countries Science and Society activities initiated by a broad range of institutions but, with a few exceptions, most of them were fragmented and far from reaching a critical mass. A full report of existing initiatives was produced by the Evaluation Partnership in 2005. It is informative to mention a few clear-cut cases. Although progress has been made, there still exist stereotypes keeping women out of science and which deprive scientific research of their contribution to the production of knowledge in many public and private sectors of activities; despite this widespread situation, the issue of "Women and Science" was almost non-existing at the level of the priorities formulated by Member States (even though gender as an issue had been integrated into FP5). The situation was somewhat different as far as science communication activities were concerned where activities could be identified at various levels for some time. A limited number of successful initiatives of various kinds had been undertaken to improve the communication channels between the scientific community and the public (*Ciência Viva* in Portugal, *la Fête de la science* in France and various

[7] Science Technology, Innovation and the Media (Belgium); Science Weeks (France); Science Education (Slovakia); Dialogue and Participation (Austria and the Netherlands); Women and Science (Germany and Slovenia); Research and Foresight (Greece); Ethics (Denmark and Slovenia), and Governance, Risks and Expertise (Switzerland).

[8] CREST cluster activities were evaluated by the CREST rapporteur Mariann Samuelson in the *Report on the implementation of the Science and Society Action Plan* (2004), not published.

science festival or weeks in several European countries, as well as several individual initiatives some of which received subsequent recognition by being awarded a Descartes prize award). Clearly, there existed a will, in several countries, to engage the public in scientific culture activities and those initiatives provided examples to be benchmarked, and eventually reproduced at the European level, through the support of a specific programme. There existed a broad, but still vague, consciousness that the Lisbon strategy requires the involvement of a great number of young people in various knowledge-based activities, and particularly in scientific research. At the same time, young people, for various reasons, seem to be less motivated for engaging with the long term studying required for science and more commonly perceive scientific careers as insufficiently attractive and disparate from popular youth culture. It is in this context, that the necessity of addressing the issue of science education on a broad basis emerged. The science education research community needed to be encouraged to engage more in activities linking research with practice and thus contribute to closing the gap that exists between expertise and teaching practice in this area.

Lately, in May 2004, the report *Europe needs more scientists* ([9]), prepared for the Commission by a panel chaired by Professor J. Mariano Gago (presently Minister for Science, Technology and Higher Education in the Portuguese government), has highlighted the importance of these issues and stressed that they have an impact on the possibilities of recruiting engineers and scientists who are needed to facilitate the knowledge-based economy. As far as science policy activities were concerned, science policy studies were rather well developed in several countries but few of them were dedicated to Science and Society issues on a sufficiently large scale.

A notable exception were individual themes such as risk governance and the role of scientific expertise in the decision making process (in a context where a gap is existing between science and the world of politics) were emerging and as various national experiences demonstrate (in Scandinavian countries for example), encouraging the participation of citizens (through consensus conferences, juries, etc.) in debates on the potential impact of new technologies can be both productive and revealing. Lastly one must observe that the potential impact of developments in biology and genetics on human life have raised new ethical issues in the 1990s which had to be examined more deeply (somewhat reminiscent of the ways in which, in a different context, the development of nuclear energy with its military and civilian dimension had also raised ethical issues in the 1970s), although the Fifth Framework Programme had already launched activities in this area.

It should be stressed that almost none of those existing activities had a European dimension, and

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[9] European Commission, *Europe Needs More Scientists*, Office for Official Publications of European Communities, Luxembourg, 2004

that providing a platform to undertake joint activities between European partners in this domain could be considered as an important tool for a thoughtful approach to implement the Lisbon agenda. The EC Action Plan had clearly identified the need to broaden such activities in the European and national context and for a more coordinated approach by using the FP policy instruments (co-ordinated actions, specific support actions, networking, accompanying measures, studies, etc.) and by providing the means for wider dissemination of ideas and outcomes of experiences through forums and conferences. Furthermore, among the new EU Member States, that joined the Union in 2004 and 2007, very few had explicitly included Science and Society activities in their national science strategy so that their participation in the European programme could be considered as a crucial catalyst for initiating similar localized activities.

There were thus several compelling policy arguments for launching a "Science and Society" programme for the first time in the context of the Framework Programme during FP6. It was considered as being the first attempt at the European level at undertaking common activities between European partners to address issues at the heart of a new relationship between science and society for many years to come. This programme had several objectives. It was considered as a catalyst for promoting Science and Society activities with a European dimension with a large degree of "transversality" (involving multidisciplinary activities, various categories of actors and tools, and a broad range of experts). The programme was in priority an "Action programme" (development of new tools, identifying useful and successful practices, etc.) to implement a fraction of the 38 actions of the Action Plan through activities which should be knowledge-based. It aimed at promoting actions which would allow a reappraisal of the role of scientific institutions and of their links with society at large, exchanging experiences on the contribution of science in the policy-making process and on new modes of science communication and education. Research activities, as such, were not a-priori considered as a priority among the objectives of the programme, although research issues were introduced in the later versions of the work programme.

A specific action, the Descartes prize that was launched in the year 2000 with the specific objective of rewarding excellence in science achieved through European collaboration was incorporated into the programme. Lastly, it is important to note that the issue of scientific culture was not a specific objective of the work programme. Several actions of the SASAP aimed at disseminating scientific information to the public through various channels (science weeks, exhibitions, audiovisual documents, etc.) and at building bridges between science education and cultural activities, such as those of museums.

Scientific culture was thus embedded into two thematic areas of the programme: science education and science communication. As a result the focus of the scientific culture activities

was rather narrow by design. Partly because this was recognized as a shortcoming along the way, scientific culture was introduced more explicitly in the latest phase of the programme.

In summary, five main areas have framed the activities of the Science and Society programme in recent years: (a) Science Education; (b) Scientific Advice and Governance; (c) Ethics; (d) Women and Science; (e) Science Communication.

These are the domains of activities which we have sought to assess according to the terms of reference of our mission.

The programme was implemented through “coordination actions”, “specific support actions” and “specific targeted research projects”. 19 calls were involved between February 2002 and March 2006. The total budget for the calls amounted to 71.5 M€. To this budget we must add administrative expenses on communication (publications and conferences) at a level of 1.9 M€ on average, per year, for Directorate C which was in charge of the Science and Society programme as well as Communication for the entire DG Research.

2. Terms of Reference and Methodology

2.1 Terms of reference

The European Commission gave us the mission of performing a Mid-Term Assessment of the Science and Society programme, which was launched with the FP6. The activities that we had to evaluate were implemented by indirect actions under the Specific Programme "Structuring the ERA" and were organized into three axes that were subdivided into a total of five themes:

Bringing research closer to society

4.3.1 Scientific advice, governance and reference systems

Responsible research and application of Science and Technology

4.3.2 Ethics in Science

4.3.3 Uncertainty, risk, and the precautionary principle

Stepping up the science/society dialogue and Women and Science

4.3.4 Science and Technology culture, young people, science education and careers

4.3.5 Women and science

The principal **objective** of the Mid-Term Assessment exercise was to evaluate whether and to what extent the activities implemented by Directorate C of DG Research are on course to meet their objectives, by:

- Reviewing a number of representative actions across the five Science and Society themes stipulated in the FP6 Specific Programme "Structuring the ERA",

- Combining the outcome of this review with the finalised or intermediate findings of earlier or ongoing evaluations,

- Analysing the indirect impact of the Science and Society actions on other policies and activities supported by the European Commission, by the Member States or possibly by international entities.

We received also the task of formulating recommendations for the future evolution of the programme during FP7.

2.2 Evaluation process

The work was organized on the basis of a two level structure involving two separate groups of experts chaired by the same Chairperson.

In the first stage, a panel of five experts, the *Project Reviewers Group,* reviewed and assessed the accumulated and potential impact of a selected set from the following activities:

- Projects supported under FP6 (Specific Support Actions, Coordination Actions, Specific Targeted Research Projects)
- Work accomplished by expert groups
- Dissemination and exploitation activities, websites, Workshops, Conferences, etc., which were funded under FP6 and were operational or finished as of February 2006

Review experts evaluated a sample of 27 projects of a total of around 100 indirect activities that have been supported with EU funding. The Commission Services provided a list of all funded FP6 Science and Society activities with brief information on each one.

Each sector of Directorate C suggested a set of 5-6 projects that were chosen on the basis that they were (i) relatively advanced in their process of implementation, (ii) representative of the types of activities that had received funding, (iii) thought to demonstrate innovative approaches with a strong potential impact on future policy, (iv) prone to increased risk either due to the initial design or to obstacles that had emerged along the way. The reviewers also requested information on additional projects that they thought useful to examine. The inputs to the evaluation were the project proposals, all the available project reports and the project fiches of these sampled actions, as well as other background materials such as the Science and Society Action Plan, the work rogramme, the Directorate C mission statement and statistical information on the funded projects.

The Project Reviewers Group worked together to develop a set of review criteria. The reviewers then organized their work into five subgroups of three experts each. Each subgroup reviewed activities in one of the following domains: Science Education and Scientific Culture, Scientific Advice and Governance, Ethics, Women and Science, Science Communication. Each of the three experts in a subgroup wrote an individual evaluation of each activity in the corresponding area. The subgroup as a whole, co-coordinated by a leading expert member, used these individual activity review reports (three for each activity) and wrote one synthesis review report for each of the five domains. In total each, member of the Reviewers' panel, reviewed the work of about 15 activities and took the leading role in writing one synthesis review report for a particular domain.

In each of the synthesis review reports, an effort was made to include brief background information on the domain, a description of the current policy context in that domain, a set of cross-cutting issues that emerged through the review of individual activities and a set of domain-specific recommendations for the future.

The outcome of the first phase of the Assessment Exercise was communicated to the second panel of experts in a joint meeting, which marked the kickoff of the second part of the exercise.

The second phase of the evaluation was performed by a separate group of 6 experts, the *Impact Assessment Group*. This second group integrated the review reports from the first phase with findings from one other evaluation solicited by the European Commission and performed by The Evaluation Partnership in June 2005. They also developed recommendations addressing the issues of scale, impact and specificity of activities with the explicit purpose to support and improve policy development, both at European and national level, in terms of relevance, effectiveness and efficacy. In this context special attention was given to identifying new orientations that could provide potentially fruitful avenues for future action at the level of Member States and the European Commission.

The Impact Assessment Group used as input to their work, the synthesis review reports developed by the first panel, the FP6 work programme for Science and Society, as well as other documents provided by the Commission. The work of this second panel of experts was also organized on the basis of the same five domains, but was extended to also elaborate on the theme of Scientific Prizes. Each expert took primary responsibility to address one of the domains, but referred to the whole set of input materials. The individual evaluations were discussed by the whole panel in two rounds. The chair and the rapporteurs then undertook to provide the synthesis of the whole evaluation exercise and a presentation of its results and recommendations in a report.

2.3 Evaluation criteria

Each of the two panels generated its own set of specific **evaluation criteria** that were designed to respond to the objective of their task as described above**.** The *Project Reviewers Group* used the following criteria:

- Relevance of the project outcomes and significance for the objectives of the Science and Society component of FP6.
- Methodological appropriateness of the project.
- Quality of the procedures of the project implementation.

- Has the project achieved what the consortium has promised to achieve?
- Does the project go beyond state of the art? Did the project participants expect to do so? Degree of innovation.
- Is there evidence of integration of activities through collaboration among the project participants? Do the project outcomes demonstrate European added value?
- Are the project outcomes disseminated to all relevant stakeholders? Is the project disseminated widely enough within the Commission?
- Is there evidence of impact on stakeholders outside the partnership? *[Degree of impact; relevance of the impact; on what stakeholders?]*
- Is there evidence of sustainability beyond the funding period?
- Examples of good practice that can be highlighted from this project. Potential future impact of the project on public policy, regulation or practice.
- Importance of the core project idea and the project rationale for future Science and Society policy initiatives, actions or cross-thematic partnerships with other parts of FP.

Moreover, in relation to the S&S activity as a whole, other relevant issues were to be assessed:

- Does the internal organization of the Commission cover the whole spectrum of Science and Society objectives?
- Do the funded projects cover the whole spectrum of Science and Society objectives?
- Adequacy of procedures for project evaluation and monitoring.
- Coordination with other parts of the Commission and with Member States.
- Do the structured (funded) activities cover the objectives of the Action Plan?
- Commission activities for raising public awareness.

The *Impact Assessment Group* also formulated its own criteria, as follows:

- Consistency between activities and the three missions of Directorate C as listed in the terms of reference (with reference to the Science and Society Action Plan):
    a) Bringing research closer to society,
    b) Responsible research and application of Science and Technology,
    c) Stepping up the science/society dialogue and women and science.

- Issues of scale: assessment of the proportionality of budget and time frame to the objectives of activities,
- Issues of specificity: whether the focus on issues and the choice of topics is appropriately specified,
- Coverage of transversal issues, i.e. dissemination, innovative approaches, project clustering, European added value, activities that combine the different themes,
- Assessment of the policy relevance as well as strengths and weaknesses of the Science and Society activities of FP6,
- Potential impact on "policy environment" (including various "circles" of policy-makers at European and national level as well as other stakeholders),
- Time evolution of the activities and funding priorities as they are formulated in the latest versions of FP6 work programmes for S&S (recent calls for proposals, conferences, workshops, expert groups etc.).

It should be noted that both Expert Groups recognized the need for more reliable impact indicators of Science and Society activities.

3. Assessment of the achievements in individual thematic areas

3.1 Science Education

a) Introduction to the theme

Background Information

Some of the problems that are well documented in science education are listed below:

- There is a serious quality problem in the learning outcomes of science education. International assessment studies such as PISA and TIMSS have repeatedly demonstrated that everywhere, without exceptions, there is a large gap between what is taught and what is learnt in school science.
- There are also many reports that science teaching deviates sharply from existing know-how on effective teaching and learning. The content delivery model often dominates the thinking of educational administrators. Transmissive pedagogies are widespread at all levels of the educational ladder becoming more dominant as a child grows older. The important pre-requisite of active intellectual engagement by students for extended periods of time remains unrecognized or distantly removed from classroom practice.
- Most educational systems implement science education at school level as a means to prepare future professional experts in the natural sciences and engineering. There is widespread acknowledgement that the knowledge society needs flexible educational systems that, above all, prepare people who can think critically, communicate, work together productively and have a lifelong thirst for continuous learning.
- Despite (or because of?) the common emphasis, by school education, on developing early expertise in natural science we are failing to attract young people into research or science and technological careers in sufficient numbers to support sustainable development.
- Unusually large gap between research and practice. There is a diverse web of institutional cultures and administrative structures that act as barriers preventing school-based innovation, thereby helping to maintain the immense gap that exists between existing know-how and current teaching practice.
- Many initiatives to reform science teaching work outside educational institutions and seek to target teachers directly. As a result, in the best of cases, they constrain their impact to gifted science teachers who are committed to quality on a voluntary basis,

failing to engage with the whole range of teachers of science and with the realities of classroom teaching practice.

- In many Member States there are no specified standards for science learning outcomes even though science and technology are recognized as a priority area. As a result, the level of innovation in evaluation and assessment of learning outcomes is not satisfactory.
- There is an existing gap between formal science education in schools, informal science activities in museums, centers, parks and non-formal science learning at home or in recreation areas. As a result of the lack of co-ordination of the diversity in learning objectives, priorities and methods, the impact of the combination on learning is minimal.

Around Europe, it is possible to identify ongoing activities that seek to address these issues:

- There is existing expertise on the use of science teaching and learning as a means to promote reasoning and critical thinking. This is particularly important given the need to strive for *science learning by all from a young age.*
- There are existing technologies and pedagogical know-how that can be used to promote the development of modeling and simulation skills from age 10.
- There is emerging technological innovation in the area of design, development and validation of teaching/learning activity sequences.
- There is increasing awareness of the importance of promoting holistic approaches to science teaching and learning especially with regard to integrating conceptual understanding, problem solving, an appreciation of the nature of science, procedural skills, reasoning and argumentation skills, self regulation and attitude development.
- Inquiry-based teaching and learning has been recognized as a productive framework of pedagogical methodology that can be used to promote educational reform and substantial improvements in the quality of the learning outcomes.
- There is intensive activity on developing new ICT and web-based tools for teaching and learning. Science is probably the principal knowledge domain for testing and refining ideas and technologies related to eLearning.

Specific policy context

The Science and Society Action Plan made promoting science education and culture in Europe one of three main pillars of the new partnership. Assuring that citizens have the knowledge they need and attracting young people to science careers are both important goals in the Plan. It is important to note that this is happening at European level under a severe constraint: the

Commission has no mandate in education, and the evaluation of the SASAP by the Evaluation Partnership ([10]) demonstrated that national governments are the dominant actors in science education, before and since the SASAP. Nonetheless, the Science and Society programme can support the goal of making school science exciting and effective through communication and sharing across Member States. Indeed, to reach the Lisbon Agenda goals, Europe requires top-quality science education, a point also stressed in the report *Europe Needs More Scientists*. While other parts of the Commission assumed responsibility for some of the SASAP's actions in science education, the Science and Society programme has taken the lead on Action 15, education research and development projects specific to science and technology, and has also provided some funding for teacher development and bringing research and education actors together.

It is possible to identify three parallel policy strands in science education in Europe:

- DG Research has been promoting participative actions that promote wider involvement of institutions and professionals (mostly scientists and teachers) in efforts to improve the experience of children with authentic science and to infuse excitement about the scientific enterprise in society. A number of issues have emerged in this attempt: Bridging the gap between non-formal and formal education has emerged as a method that could promote the transfer of innovative science education activities from science and technology centers to schools; Encouraging scientists from research laboratories and universities to take a more active role in the design and implementation of school education is recognized as a tool to promote more authentic views of science; Encouraging diverse institutions (media companies, curriculum developers, local administration…) to take a more active role in non-formal and informal science education is promoted as a mechanism of mobilizing activity in this area. Actions for promoting the differentiated involvement of girls in science education and the attraction of disabled people and people from minority communities to science studies have been recognized as a priority area.

  Actions that are designed to bridge the gap between science education research and science teaching practice have been recognized as a priority area but require additional support in the coming years.

- DG Education and Culture has been working on the European Objectives for Education and Training. This is a longstanding activity that follows the methodology of open co-ordination of administrative systems at the level of Member States. Three ideas have

[10] The Evaluation Parnership, *The Evaluation of the Science and Society Action Plan*, (DG RTD internal document)

emerged as priority issues relating to the objective on *Increasing Participation in Mathematics, Science and Technology*: Benchmark adopted on decreasing by 50% the existing gender gap in science studies by the year 2010; University – school partnerships have been identified as a potentially powerful engine for promoting reform in science education and improvement in the quality of the learning outcomes in this area; Identifying examples of successful practice and promoting exchange of ideas at European level has been recognized as a potentially productive mechanism for mobilizing systemic reform.

- At the level of Member States, there are a small number of initiatives that seek to promote inquiry oriented science teaching, broader emphasis on laboratory work and student involvement in science week and science competition activities. In some countries there are systemic initiatives to promote inquiry-oriented teaching and learning. These include classroom-based research as a mechanism for understanding the issues that contribute to effective science learning as well as contextualized approaches to science teaching and learning.

Objectives

The objective of the first call in 2003 was to "establish a pan-European initiative to enhance science teaching in schools," and "to raise the interest and motivation of boys and girls in science and technology." The focus was on providing a mechanism for exchange of ideas and approaches. The later calls, developed in collaboration with the Science and Society Advisory Group, took into account the results of the first call as well as recommendations of the Gago Report. The 2004 call focused on three areas: introducing inquiry-based science teaching methods into the primary school curriculum; lowering barriers for students from disadvantaged groups to enter science careers; and reinforcing links between schools and industry to strengthen the transition to work. The 2005-6 call moved on to encourage actions to understand the strengths and weaknesses of teaching practices, including their gendered dimensions, and to understand the role of performance indicators and assessment in the education process.

Activities

The calls resulted in 26 funded projects. The first round supported a cluster of projects to develop curricular materials, organize teaching festivals, strengthen ties between schools and informal education, and disseminate inquiry-based teaching methods. The second round funded several projects for inquiry-based materials in various fields of science, and also research on differences among boys, girls, and migrants in their experiences in the science education classroom. The third round of funding supported projects to bring teaching practice closer to pedagogical research, to link schools to universities and to industry, and to develop materials to

help attract girls into science and engineering careers. Two calls for tender resulted in special studies to identify and disseminate best practices, one on incorporating research findings into teaching practice and the other on mentoring and science ambassador schemes. This theme also supported European Contests for Young Scientists in Budapest, Dublin, Moscow, and Stockholm.

b) Assessment.

1) Are the activities in line with the three missions of Directorate C as listed in the terms of reference?

The programme activities were clearly in line with the missions of Directorate C, and the detailed alignment between programme objectives and project foci has strengthened over the course of FP6, even though several of the areas in the calls for proposals did not attract proposals at sufficiently high quality levels for funding.

The theme has responded to calls for a greater linkage between teaching and pedagogical research through its formulation of calls and through the calls for tender.

2) Issues of scale: assessment of the proportionality of budget and time frame to the objectives of activities

While the projects are larger on average than those in other Science and Society themes; they are still small in scale compared to the educational enterprise they are intended to influence. If greater resources were available, the projects could be less scattered among science subject areas and provide greater coverage.

3) Issues of specificity: whether the focus on issues and the choice of topics is appropriately specified

Given the programme's very limited resources, the focus on two dimensions of action is appropriate: better learning outcomes through inquiry-based teaching methods and broader recruitment to science careers through reaching out to women and migrant groups.

4) Coverage of transversal issues, i.e. dissemination, innovative approaches

The projects intersect well with gender issues and contribute to the science communication objectives, involving a significant amount of collaboration with science museums, professional societies, etc. There is a need for more intensive activity to raise issues of science ethics and science-related governance in educational contexts.

5) Assessment of the policy relevance as well as strengths and weaknesses of Science and Society activities of FP6

Dissemination appears to be an across-cutting weakness among the projects, with too much reliance on workshops and conferences.

6) Potential impact on "policy environment" (various "circles" of policy-makers and stakeholders and on policy-making)

Not enough engagement of decision makers from early stages of the projects can be found. The range of participants has not included many school authorities so far, and policy-makers have not been the primary audience for most projects. It is difficult to see how innovative activities can have a sustainable influence on the workings of educational settings without serious involvement from educational policy-making authorities.

7) Evolution of Science and Society activities in the latest versions of FP6 work programmes for Science and Society (recent calls for proposals, conferences, workshops, expert groups etc.).

However, there has been gradual movement in focus towards the institutional environments for science education. This is certainly a positive direction, and should increase the impact of the effort.

c) Recommendations

1. The theme should focus its resources on a few kinds of actions that are likely to have the greatest influence on its desired results, that is, better learning outcomes and more effective recruitment to science and engineering careers. Presentations of the programme's goals and objectives should be clear about how its actions will contribute to the desired results, including indicators of the pathways to success.
2. Future action in Science Education should continue on its path towards identifying and disseminating best practices in teacher professional development and systemic educational reform.

   There is also a need to promote the development of ***structures*** for teacher professional development (e.g. a European credit transfer system for teacher lifelong learning would enhance the incentive structures and promote teacher mobility)
3. The theme should continue to support research on the culturally-specific issues of gender and disadvantaged status in European science education and thus provide leadership for Member States in developing a base of empirical knowledge on these

important issues. The need to understand the influence of performance indicators and assessment practices in the education process should also remain a priority.

4. Science Education policy should continue to strengthen its encouragement for the connection between pedagogical research and teaching practice by announcing this evaluation criterion explicitly, enforcing a minimum standard for it and giving preference to proposals that go beyond the minimum, and by including pedagogical researchers on its evaluation panels.
5. The theme should continue to strengthen its encouragement for engagement with policy-makers in education by announcing this evaluation criterion explicitly, enforcing a minimum standard for it and giving preference to proposals with stronger policy engagement plans, and by including education policy-makers or their staff on its evaluation panels.
6. Science and Society should work to include students and young people in projects in all the thematic areas, including ethics and governance as well as Women and Science and science communication.
7. Systemic reform. There is a strong need to promote systemic initiatives that include development of teaching and learning modules, professional development and support measures for effective school science teaching in order to create examples of successful science education reform that are currently lacking.
8. Promoting reform in existing science teaching practices will require more co-ordination of the activities of DG Research, DG Education and Culture, University-school partnerships, as well as national and local educational authorities. Extensive and substantial commitment to teacher professional development will be required to achieve relevant objectives in the long term.
9. Initiatives should promote partnerships that include existing institutional arrangements. The necessary (prerequisite) reform in administrative structures is not likely to be promoted with initiatives that target teachers as individuals. Bidirectional communication and productive partnerships with schools and Universities is a crucial aspect for many projects that aspire to have an impact on educational systems, student learning or attitudes.
10. Broadening institutional participation in science education should remain an area of priority. More intensive efforts are needed to engage the employers and users of scientific skills in the science education system. Industry is often absent in existing

projects and could usefully bring a productive perspective to any effort to re-examine curriculum priorities and educational innovation projects.

11. There is a need to promote more activity at European level that aims to use classroom-based research as a mechanism for understanding the issues that contribute to effective science learning. Additionally, the development and dissemination of new teaching tools for science learning needs to be interpreted as an intensive research and development activity and not as an implicit outcome of teacher networking. Only in this case, can we support the development of new tools of high enough quality to have an impact on science education practice.

3.2 Scientific Advice and Governance Activities

a) Introduction to the theme

Background information

There are widespread practices in terms of the procedures that Member States and individual funding institutions follow in order to set science and technology research priorities. There is also great heterogeneity across Member States and across institutions in the procedures that are used and, less commonly, in the extent to which science advice is sought and taken into consideration in policy development. On the whole, both of these issues are recognized as important throughout Europe. However, insufficient attention has been given to developing reflective or monitoring exercises to study either issue in most local settings and at European level.

As science continues to become more complex and diversified in its methodologies, the issues of maintaining relevance in scientific research and safeguarding balanced and rigorous expert scientific advice will become more prominent and corresponding decisions, as to how to achieve this, will become more elaborate on the part of policy- makers.

Specific policy context

The Science in Society Action Plan set out an ambitious agenda in relation to the role of science in governance and the challenges of the governance of science at the dawn of the 21st century. The Action Plan was prepared at a time when many leading scientists and policy-makers believed that there was a crisis of public confidence in science and technology (e.g. UK House of Lords Select Committee 2000). Subsequent social science and public opinion research suggests that at least some of this concern was overstated, at least in some countries. Principal components of the Action Plan addressing these issues include “Involving Civil Society”, “Risk Governance”, and “Use of Expertise”.

Objectives

The 2003 work programme outlined multiple objectives: "to create conditions under which policy decisions in multi-level governance are more effective in meeting society's needs, more soundly based on science and, at the same time, through inclusive participation take account of the relationship between technological innovation and social change, as well as the aspirations and concerns of civil society. The focus will be on assessing the functioning of policy-making processes in Europe and major industrialised countries worldwide."

The 2004 Call for Proposals emphasised "new evidence-based approaches" and "actions for promoting the integration of scientific information and advice in decision-making processes, including communicating it in timely, useful and understandable terms for policy-makers, particularly democratically elected representatives."

In the 2005 and 2006 work programmes, the issues of risk came at the forefront. Both programmes also called for proposals designed to "help policy-makers reconcile the constraints and conditions of a globalised economic and technological environment with risk management and societal aspirations."

These important and well-formulated objectives are key to the evolution of both national and EU-wide science advisory processes. However, they are ambitious goals and, in our view, the portfolio of governance projects actually funded under FP6 falls rather short of addressing them.

Most of the project portfolio consists of projects addressing only one objective: that of expanding public participation. The pervasive networks of governmental advisory processes consisting of expert committees, academic advisors, professional associations, government and university scientists, and civil servants who actually inform key decisions from local to transnational levels of European government have largely eluded the programme's attention. The portfolio does not address key questions related to the democratic governance of technological change under conditions of globalisation.

Furthermore, the portfolio of projects does not include research or experimentation addressing the extensive governmental scientific advisory process within the EC and its Member States. (Two possible exceptions to this situation are the *Scientific Advice for Fisheries Management at Multiple Scales [SAFMAMS]* and *Scientific Information for Policy Support in Europe [SINAPSE]* There is a need to build further on this experience).

The scope of projects funded under the heading of Scientific Advice and Governance activities seems to be narrower than the objectives set by the Action Plan and subsequent Work Plans. Indeed, the strong focus on public participation mechanisms in the FP6 Science in Society portfolio may actually have the unintended consequence of distracting attention from a serious

and challenging examination of the everyday role of scientific advice in the EC and its Member States. More widely, the difficulty to engage policy- makers in these activities echoes the experience of other strands of the Science and Society programme, which seems to indicate the possible relevance of systemic constraints to this effort.

Activities

The sample of projects examined in this review suggests that there are grounds for concern about the quality and effectiveness of the work that has been funded in this area. Six projects were reviewed in depth out of a total of fifteen. Closer examination of specific first phase evaluation criteria give cause for concern. If the sampled projects are representative of the project portfolio, then the projects overall could be described as unadventurous, of uneven quality, and having dubious impact.

Three reports were reviewed. *Governance of the European Research area: The Role of Civil Society* ([11]) largely frames science advisory issues in terms of the asymmetric expertise of civil society and scientific experts. The report entitled *From Science and Society to Science in Society: Towards a Framework for Co-operative Research* ([12]), poses a suitably broad range of questions including: "What is the appropriate role for science in the governance of modern society? How should research itself be governed? What is the function of public engagement?" The report is careful to address several important problematic issues including: the issue of representation and democracy; scale; and framing. Ultimately, however, it also narrows its scope to the role of public engagement. The report, *Mapping Science in Society Research in Europe* ([13]), surveys largely academic research on five sub-fields of Science and Society (S&S) activity and provides national profiles of S&S research in the Member States. However, the report provides rather sparse information on the specific issues and approaches included under these broad headings. As a whole, the reports provide useful summaries of current conventional thinking about public participation, but also fall short of a full consideration of significant issues for a programme on Scientific Advice and Governance activities.

[11] Banthien, H., Jaspers, M., Renner, A., *Governance of the European Research area: The Role of Civil Society*, IFOK, Bensheim, 2003
[12] DG RTD internal document
[13] DG RTD internal document

b) Assessment

1) Are Science and Society activities in line with the three missions of Directorate C?

The projects and workshops are generally in line with the Directorate's missions. However, both kinds of activities reflect a very narrow framing of the missions. The programme focuses on risk communication and public participation, while ignoring structural political and economic issues that underlie public concerns about both the governance of science and technology and the role of science and technology in governance. There is nothing in this part of the programme specifically addressing the role of women. There are also fewer links than would be expected with the Science Communication activities.

2) Issues of scale

It is impossible to say what the "right" amount would be to spend on these large issues.

However the project effort in particular focuses on a rather narrowly defined subset of public participation and risk communication activities. A suite of 16 well designed projects could almost certainly cover a more extensive range of issues adequately, although not exhaustively, so the scale of effort is not unrealistic.

3) Issues of specificity

They are too narrowly drawn to address adequately the full range of issues of scientific advice and governance specified in the programme's objectives.

4) Coverage of transversal issues

We have seen very little evidence that the governance projects have addressed transversal issues in any organized way. The synthesis report of reviewers observes "It should be noted that gender questions were not taken on by the projects we reviewed although they should clearly have appeared." The two workshops performed better in this respect, but still subjugated, for example, gender issues to the public engagement agenda.

5) Assessment of the policy relevance

The narrow focus of the activities on participation and risk communication limits the potential policy relevance of the portfolio of work. As the reviewers' synthesis report notes, "The question of public participation which has been studied in three of these projects will clearly remain important in the future. Indeed, among questions that remain open for further consideration, one is the statute of citizen's participation. Research focus in the future will have to move from public participation in debate to public participation in actual decision-making. It should more generally examine public policy-making processes. "

6) Potential impact on "policy environment"

As performed we see rather little potential impact to date. According to the synthesis report, dissemination across the board "was systematically problematic". This comment has to be interpreted keeping in mind that this is a "mid-term" assessment exercise and most of the projects reviewed had not reached a state of completion. The projects mostly explore public participation exercises. This should lead to examples of successful practice in this direction and will also inform policy-makers about crucial attributes and ideas to avoid. A greater diversity of projects would be necessary for substantial impact on the whole range of stated objectives.

7) Evolution

There is no compelling evidence on which we can form a judgement on the evolution of the proposed projects beyond this paradigm. There seems to have been more evolution in the workshops. However, the programme seems to have reproduced and entrenched existing ideas rather than innovated.

c) Recommendations

The theme of Scientific Advice and Governance should be augmented to address the full scope of issues outlined in the programme's objectives as specified in the Action Plan, work programmes and calls for proposals. The Science and Society programme is an important and positive initiative undertaken by the European Commission and a follow-up is certainly necessary. There is clearly a lot that needs to be done, both in terms of achieving what can only be developed at this level and also in terms of seeking the economies of scale that effective and more involved co-ordination can afford. However, the response to the calls seems to clearly fall short of meeting some of the objectives.

Hence, there seems to be room for pre-emptive engagement with the target audiences in order to promote more balanced participation that will have an increased possibility of meeting the very worthwhile objectives as stated.

3.3 Ethics

a) Introduction to the theme

Background Information

Ethics in science is an area of widespread public concern that is confounded with public perceptions of science and technology but also has enormous implications for scientific practice. The issues that are mostly under focus concern newly developed technologies or newly

identified risks. Equally important issues that tend to receive less attention concern the application of old technologies in new areas, animal welfare in the context of the science enterprise and the marked heterogeneity in policy, procedures and constraints related to research with human subjects.

Specific policy context

Ethics is a special domain within the European Union. As a principle, ethics is not a part of the body of European law. Even though common European standards have been initiated in many ethics-related areas, such as fundamental rights and equal treatment, ethical pluralism is recognized across the Member States. From this, it follows that it is the mandate of the individual Member States to regulate issues related to ethics in science and technology. Still, the European Union makes significant efforts in the following domains of ethics:

1) Promotion of fundamental rights,

2) Ethical review of research protocols,

3) Funding research on ethical, legal and social issues raised by science and technology,

4) Promotion of pan-European and international dialogue on ethics.

Taking into account these four activities, ethics has become an important domain where certain European standards have already evolved. Moreover, the coexistence of ethical pluralism and common European standards make ethics a vivid and important strand within the Science and Society programme.

Objectives

The main objective within this theme is to encourage the development of harmonious relations between Science and Society as well as to foster critical thinking on ethical questions related to science and technology.

The Science and Society Action Plan specifies in Actions 29–34 the main goals in the field of ethics:

1. An information and documentation observatory will be developed to help track and analyze the development of ethical issues in science at national and international level (Action 29).
2. An open dialogue will be established between NGOs, industry, the scientific community, religious, cultural groups, philosophical schools and other interested groups, stimulating an exchange of views and ideas on a range of critical issues, such as the ethical impact of new technologies on future generations, human dignity and integrity, ‘infoethics’ and

sustainability. A variety of mechanisms will be used (focus groups, polling exercises, debates, workshops or institutional forums etc.) (Action 30)

3. Model courses and training modules will be developed in order to raise the awareness of researchers in the field of ethics (Action 31).
4. Networks of ethical committees will be fostered at both national and local levels. The aim will be closer cooperation and a more effective exchange of experience and best practice (Action 32).
5. An international dialogue on ethical principles will be developed through a series of conferences and workshops. An important aim will be to build up a capacity for ethical review in developing countries (Action 33).
6. Networks of animal welfare committees will be fostered and training of young scientists on animal welfare issues will be promoted to support the implementation of European legislation on the protection of animals in research (Action 34).

Activities

The following documents and events served as the basis for assessment:

- The synthesis report on ethics from the Review Panel,

- The *25 recommendations on ethical, legal and social implications of genetic testing* ([14]);

- The report on the *Ethical, legal and social aspects of genetic testing: research, development and clinical application* ([15]);

- The report: *Facing the Future Together: Conference of the Ethics Committees in Europe* ([16]),

- The five opinions of the European Group on Ethics (EGE) released during the period in question,

- Information on 32 projects that were funded within the Ethics unit in Directorate C, including information on EUREC-Network project aiming at the creation of a European network of networks and a platform of exchange for Research Ethics Committees (REC) as a forum of partners with added value in carrying out the work at a European level.

[14] European Commission, *25 recommendations on ethical, legal and social implications of genetic testing,* Office for Official Publications of European Communities, Luxembourg, 2004

[15] European Commission, *Ethical, legal and social aspects of genetic testing: research, development and clinical application,* Office for Official Publications of European Communities, Luxembourg, 2004

[16] European Commission *Facing the Future Together. Conference of the Ethics Committees in Europe,* Office for Official Publications of European Communities, Luxembourg, 2004

- Information on various conferences and workshops funded by the Commission, such as Ethical and Social Implications of Biometric Identification Technology (Dec 2005); Bioethical Aspects of Human Health (Oct 2006); The European Network of Research Ethics Committees, launched in January 2005.

b) Assessment

1) Are Science and Society activities in line with the three missions of Directorate C?

All projects reviewed in the Ethics theme are concerned with topics that are central to the Ethics component of the Science and Society programme. All are well designed and well managed from a scientific point of view, and all are likely to achieve their stated scientific and networking aims.

2) Issues of scale

The type of action and the budget requested varies significantly across projects and it is not always obvious that there is sufficient reason for these variations. Only one of the projects involves significant and costly empirical research, which correctly puts it in the STREP category. The participation of the new Member States is still low and in general their budgetary share is significantly less than the share of the researchers coming from the EU15.

3) Issues of specificity

The issue of ethics in science is often simplistically reduced to a comparison of various legislative and regulative models in Member States. The projects mainly focus on the most recent fields of technologies, such as genetics, reprogenetics and nanotechnology. While it seems reasonable to promote scientific research in new and rapidly expanding fields, such as nanotechnology and genomics, scientific novelty does not necessarily raise brand new ethical dimensions while a new application of an already routinely used technology may involve entirely new ethical questions. For instance, if genetic tests are used for insurance, differentiated access to sport and various commercial purposes, specific and new ethical issues emerge (such as data protection and access to genetic information, a clash between commercial law and bioethics, discrimination and adverse selection) that go well beyond those entailed in genetic testing itself. Some critical reflections on the exclusive focus on genetics can be seen in the *25 Recommendations on ethical, legal and social implications of genetic testing* (2004).

4) Coverage of transversal issues

Dissemination is an area where improvements can be made, both at the proposal and the implementation stage.

The projects generally achieve good dissemination to the academic audience, but dissemination to stakeholders, policy-makers, the public and the relevant parts of the Commission (especially outside DG Research) is very variable. Dissemination of the EGE Opinions needs to be intensified and improved so that it can become more targeted to reach the appropriate audiences. Commonly in Ethics research, the most crucial population to reach is not the Ethics researchers but rather the science researchers and science practitioners working in the corresponding field. This needs to be taken into account in designing future activities.

5) Assessment of the policy relevance

There is a tension between the scientific and social dimension of the Science and Society activities and as a consequence, projects show a kind of separation between these scientific fields despite the stated call for the multi-disciplinarily. In terms of the need for ethical thinking to influence science policy development, one can identify a strong need for wider participation from social science researchers and yet the projects and other activities, for some reason fall short of this critical need.

In terms of the policy implications and potential impact of the funded activities in this area, there is also a need for more involvement of policy-makers and institutions that go beyond the commitment to participate but undertake a commitment to explore policy shifts in their practices. More initiatives need to be undertaken by the Commission to relay activities of funded projects and contribute to policy-making, such as international conferences with stakeholders in the fields of interest where partners in funded projects have a role to play too and can promote further capacity building.

6) Potential impact on "policy environment"

The main target group in many of the funded activities is still the academia which leads to a risk that there is a lot of expertise being developed that remains within closed circles. Nevertheless, policy-makers, legislators should benefit from the Ethics projects and there is the need to raise issues related to the existing gap between research and practice in Science Ethics. Reference to the projects is insufficient. Conferences and workshops organized by the Commission seem to have more significant impact; however in these events the recent findings of EU projects have not yet been integrated. Some projects (for instance comparison of the emerging ethical issues and legal differences impacting on European clinical trials, including a training workshop for researchers in the new Member States) seem to have a wide and multi-layered policy impact.

7) Evolution.

Various activities demonstrate the good progress made in achieving the goals formulated in the Action Plan, except for Action 34. Capacity building is focused mainly on RECs.

c) Recommendations

1. There is a strong need to foster cross-disciplinary dialogue in this field. Integrating ethical issues in a substantial manner in other strands of Science and Society as well as, more widely, the Framework Programme needs to become a priority. For instance, there is much usefulness in raising ethical issues in educational contexts.

2. Genetics, nanotechnology and, more generally, the latest technologies tend to dominate almost exclusively the ethical landscape of the Science and Society activities. There is a need to realign this emphasis so that it covers all areas of ethical novelty rather than concentrate on ethical issues in novel science disciplines.

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

4. Most of the projects and activities in Science and Society tried to work against the existing gender-based inequalities. However, only very few gender-specific aspects were singled out. There is recognition that specific ethical issues are raised by the impact of technology on "vulnerable groups". There are, however no concrete measures taken to involve members of these groups in current research on these particular issues. Such involvement needs to be substantial and also compensate for the difficulties that no doubt will be encountered.

5. The Commission might want to develop and disseminate a guidance document on highlighting good practice and providing hints for how to achieve appropriate dissemination within the Commission (beyond DG Research) or in the European Parliament or take other initiatives to help project coordinators reach relevant decision-makers at the European level. The Commission should also review its internal dissemination procedures.

6. There is a need for more initiatives to be undertaken by the Commission to relay activities of funded projects and contribute to policy-making, such as international conferences with stakeholders in the fields of interest where partners in funded projects have a role to play too and can promote further capacity building.

7. There is a need for mapping existing practice in science-related ethics and also develop indicators to monitor its development in the future.

3.4 Women and Science

a) Introduction to the theme

Background information

The issue of women's participation in science was essentially raised by the European Commission and has been promoted actively for nearly ten years. In 1998, DG Research set up an expert group on Women and Science (the term is used broadly here, including the social sciences, engineering, and technology and computing) and charged the members with the task of preparing a report on Women and Science policy in the European Union. One major difficulty recognized from the outset was the lack of systematically collected and published statistics. Even when statistics were collected, presented and arranged systematically, there were problems of interpretation in the absence of other data. These difficulties in establishing a clear picture at Member State level were further compounded by problems of making comparisons across Member States. Nevertheless, the ETAN report *Promoting excellence through mainstreaming gender equality* ([17]) underlined some immediate striking facts. Women science professionals tend to work in the public sector, especially in universities, much more commonly than in the private sector. Throughout the EU, despite the increased participation of women in higher education, and despite the increase in women taking science subjects and moving into doctoral and postdoctoral studies, there remain remarkably few women in top jobs in science in any of the Member States. Moreover, notwithstanding the fact that different systems and cultures operate in the respective Member States, with very few exceptions, the overall percentage of women in top science positions was extraordinarily similar. Crucially, there were remarkably few women on important scientific committees and in key policy-shaping arenas.

The situation has been slowly changing since then: data are being collected (see *She Figures 2003* and *She Figures 2006*) and benchmarking activities have been promoted among Member States (Helsinki Group on Women and Science). Mainstreaming the gender issues in national and European policies is a long-term strategy for the Commission.

This strategy focuses on transforming systems, structures and cultures, on integrating equality into policies, programmes and projects. It is an EC policy also in RTD, and has been signed by all Member States. The Science and Society Action Plan included advice on how best to achieve this.

[17] European Commission, *Promoting excellence through mainstreaming gender equality*, Office for Official Publications of European Communities, Luxembourg, 2000

Specific policy context

Both the ETAN report (2000) and the conference *Women and Science: Making Change Happen* (2000) exposed a most complex agenda to be addressed by the Commission and articulated a wide range of recommendations in terms of policy points and of specific research on gender and science to make political actions possible. Data so far available showed dramatic gender imbalances, strong vertical (along hierarchies) and horizontal (across disciplines) segregation, pay gap etc. Thus from the beginning, epistemological questions such as "gender in the substance of science" were addressed besides foci on both direct and indirect mechanisms of exclusion and discrimination, on quality and fairness in scientific professions, on processes of peer review, balance in decision making bodies, etc. Another line of activities has been networking, starting with the *Declaration of Networks Active in Europe* (1999), and structures such as the Helsinki Group on Women and Science with national representatives. The Unit "Women and Science" in Directorate "Science and Society" was founded in 2001. Despite its rather recent opening, within a short period gender experts on European and national level were mobilized to produce a comprehensive base of knowledge, and basic networks and structures were established by the EC. Secondly, the agenda has naturally grown to a very broad range, with two main foci: on the participation of women in science and technological development and on the integration of the gender dimension throughout European research.

Objectives

The two main priorities in this theme relate to raising awareness about women's participation in science and technology and developing structures for support and monitoring. In the Action Plan, four main *objectives* were articulated: establishing a European platform of women scientists (Action 24); monitoring progress towards gender equality in science (Action 25); mobilising women scientists in the private sector (Action 26); promoting gender equality in science in the wider Europe (Action 27). These roof concepts stand for whole sets of concrete strategies, such as exchange, models and mentors, awareness raising, elaboration of appropriate indicators and examination of the situation of women scientists in new Member States. In the work programmes, as early as in 2003, attention was paid to more specific issues such as stimulation of the policy debate in-depth work focusing on minimizing gender bias in the measurement and evaluation of scientific excellence; there is a need for longitudinal studies of scientific careers, and for fostering the role of sociology, philosophy and history of women's participation in science in the analysis of the scientific system from a gender perspective. Gender Watch System should be enhanced throughout the ERA. The key issues in this domain include women in science governance, mainstreaming strategies, public debates, gender and excellence.

Activities

Within FP6, 33 projects were funded under "Women and Science" programme, many dealing with the position of women in individual research areas including industrial research, others intending to meet the objectives mentioned above: databases, networks, public debates, training, the system of knowledge production. Simultaneously, a number of other activities have been pursued by the Unit "Women and Science". Besides several conferences and seminars, there are many reports and other publications illustrating the rapid progress of gathering information on the theme.

The following are a few examples: *Vademecum Gender Mainstreaming in the Sixth Framework Programme – Reference Guide for Scientific Officers/Project Officers* (2003); *Women in Industrial Research. Good Practices in Companies Across Europe* (2003); statistical publication *She Figures* (2003 and 2006); report *Waste of Talents: Turning Private Struggles into a Public Issue;* report *Women and Science in the Enwise Countries* (new Member States - 2004). Among the achievements, an interesting follow up of the Women In Research (WIR) conference funded by the Commission should be noted: the "Position paper" - a public commitment by the Chief Executive Officers (CEO) of 7 private companies, to increase the number of women in science and technology in the private sector (2003). The number of companies involved has recently increased to 15.

b) Assessment

1) Are Science and Society activities in line with the three missions of Directorate C?

Most of the projects in this area are concerned with *raising awareness* on issues of women's participation in science (i.e. through conferences, reports) as well as establishing *concrete structures* (i.e. databases, centres, platforms) that can provide the basis for long term strategies and measures to increase women's participation. The primary target audience are women scientists themselves, and the important part of the dialogue aimed at, is the discourse among them. Yet in order to address the gender dimension of the whole system of science, additionally the general public, researcher communities and private sector have been included to a lesser extent. The efforts of the Commission, and the objectives of individual projects show strong adherence to the main missions, but their fulfilment is only at the beginning. Nevertheless, in all the four actions (24-27) considerable progress has been achieved.

2) Issues of scale

The projects vary considerably in terms of budget. The number of projects is considerable and the overall budget for the projects and activities within this theme was relatively high. At the

same time, the agenda is and must be very broad to effectively "make change happen" - effectiveness and depth of the activities would increase with even more generous funding. In order to ensure sustainability of crucial activities it is important to aim for the long term and design for timeframes that reflect that.

3) Issues of specificity

As a whole, the activities in this area have been successful in achieving their promised goals and can be expected to significantly advance the Science and Society agenda of promoting the participation of women scientists in the wider ERA and strengthening the links between women scientists, policy-makers and the broader scientific community. The projects reflect professional organization and management, strong commitment, and systematic, effective approaches toward achieving their goals. Generally speaking, the projects also appear to succeed in reaching important groups of stakeholders such as policy-makers, industrial leaders, parts of the relevant scientific communities and the EC. There are some questions, however, concerning whether the projects succeed in their ambitions of actually *reaching and linking individual women scientists* in all parts of Europe (including e.g. women in regions in which there are no existing networks or databases, women in parts of central and eastern Europe, women in social sciences). Specifically, more attention needs to be paid to: 1) targeting and strengthening *particularly vulnerable groups*, e.g. women in post-communist countries and women in areas without easy internet access and; 2) developing strategies that respond to the cultural, professional/work and scientific *heterogeneity* of women scientists and their respective needs. There is also a clear need to strengthen the social science component in the work in two ways. First, it is important that efforts to reach the broad category of "women scientists" explicitly include social scientists as well as natural scientists and engineers.

Second, with the current emphasis of the reviewed projects to emphasize indicators of women's participation in science, qualitative social science approaches that explore and problematize issues relating to the discriminatory factors, processes, professional power structures and politics that influence women's participation could prove particularly useful.

4) Coverage of transversal issues

Dissemination efforts in the Commission activities were intense with this theme; production of information materials has been quite ample. The means used were mostly traditional, but of good quality: useful publications, leaflets, web pages are available; a few conferences have been organized. Art or multimedia means have been used only rarely so far, though they could have particular effect in addressing the broader public or students. The media in general have not been sufficiently involved, but this has been reflected upon by the Unit and belongs to future priorities. The European added value has been present in this case from the beginning;

moreover, it has been proven that the activities by the Commission played a catalytic role towards encouraging national activities. Long term sustainability structures have so far appeared only at the European level (such as the platform PLATWOMSCI).

In several of the funded projects it was unclear what the specific strategies were that the projects used to broadly and effectively *disseminate the results of their work* to key stakeholders in academia, industry and policy as well as to the general public. Since effective dissemination does also a prerequisite for being able to increase public awareness in the long term, both exist and future projects should be encouraged to strengthen their efforts in this area. The projects should be urged to consider dissemination as a core activity by developing in-depth strategies that include goals as to what groups will be reached, by what means, and how the concrete experiences will be reflexively integrated in a process of on-going improvements of the efforts made. Another critical point with regard to dissemination within the projects on women's databases concerns the urgency of further developing and linking good quality databases where both genders are equally represented. Projects that aim at integrating information from women scientists' databases into mainstream databases that are used by industries, academia and national and transnational institutions should be a future priority.

There are also some issues of concern with regard to the *long term sustainability* of the projects. Often, projects lack concrete means to reflexively follow up, evaluate and strengthen the effectiveness of their actions. For example, some projects that centred on conferences as awareness-enhancing events could have been strengthened by follow-up measures that contributed to more sustained activities and/or long term capacity building in their respective areas of concern. The lack of such measures has limited both the short-term impact of the activities and their long term sustainability.

5) Assessment of the policy relevance

There is no doubt that the activities promoted are highly relevant to the Science and Society policy to promote gender equality in science. The intensive effort to gather information and make it widely available is having an impact on national policy development in this area. More coordinated efforts are needed on the part of Member States to examine the causal issues that operate at local level and to explore ways to alleviate them. There has been also too much emphasis on statistical indicators. There is a strong need now is to move towards qualitative social science approaches that can explore issues relating to the discriminatory factors, processes, professional power structures and politics that influence women's participation.

6) Potential impact on "policy environment"

Although the activities were partly successful in reaching important groups of stakeholders such as policy-makers, industrial leaders, parts of the relevant scientific communities and the EC, the

real impact in terms of making policy-makers act more actively, to realize promises and make sure that policies be implemented, is doubtful. At the national level, the potential impact seems to be too fragmented and thus not sufficiently reaching the whole system of Science Education, and gender mainstreaming often remaining only in rhetoric.

7) Evolution

When the programme started, a considerable body of experience from around the globe had to be made available and the complexity of the theme had to be grasped. At European level, basic steps were necessary to address the problems systematically. Thus not all of the topics, though identified, could be equally addressed at the same time: the Action Plan rightly identified the first steps as preconditions for the deepening activities and the necessary subsequent research. The whole process has been well reflected upon and new topics have been gradually added to the portfolio. There is a strong need to continue this activity evolution in this area and also to promote greater activity at the level of the Member States.

c) Recommendations

1. Focus should be shifted from the issues of Women and Science in general towards specification of more concrete problems of individual groups of women. Strategies should be fostered that respond to the cultural, professional and scientific heterogeneity of women scientists and their respective needs as scientists. More attention needs to be paid to targeting and strengthening particularly vulnerable groups, e.g. women in post-communist countries and women in areas without easy internet access.
2. Future activities should be urged to take dissemination more seriously and include it as a core activity by developing in-depth strategies that include goals as to what groups will be reached, by what means, and how the concrete experiences will be reflexively integrated in a process of on-going improvements of efforts made.
3. Impact and dissemination would be stronger if the databases of women scientists could be integrated into mainstream databases that are used by industries, academia and national and transnational institutions, where both genders are equally represented.
4. Impact strategies should be broadened and deepened. A renewed dialogue with public and achieving greater involvement by the media are necessary. In this connection, innovative means of addressing and informing the public, such as multimedia, art etc. should be used more. Impact strategies should not be limited to dissemination only, but in connection with stakeholders, implementation should continue to be monitored closely.

5. The orientation of the projects which are providing knowledge-based arguments for whatever policies should focus more on qualitative research findings, or should trigger a necessary research in order to: a) make it possible to document in a closer and concrete way the hidden discriminatory practices and mechanisms in individual disciplines, time and place in individual countries - quantitative data often do not suffice as convincing arguments of discrimination; b) put greater emphasis on the gender dimension of the very nature of science. In this context, the concept of practicality should be re-defined within the Unit, and approaches of social sciences and humanities should be exploited much more as a base for action.

6. It is desirable to clarify and reconsider the conceptual framework of the activities as related to the relationship between the concepts "women" and "gender" – towards gender as the central concept enabling to grasp the theme in a most complex way. In other words, there is a need to raise the question of whether and how the "Women and Science" programme as a whole should successively develop from its current focused work on women's participation in science to explore even more substantive and crucial issues related to gender (with "gender" here defined in the social sense, encompassing work on e.g. difference, power and intersectionalities between gender/ethnicity/disability). As emphasized above, a prerequisite to strengthen the role of women in science is to gain a strong understanding of the gendered processes, mechanisms and values that shape and inform scientific practice, as well as societal structures more generally, in non-neutral, gendered ways. The crucial question is: will the "Women and Science" programme want to move toward a stronger, more explicit "Science, technology and gender" orientation and if so, what might a move such as this entail and what work should be initiated to move in this direction? We urge the EC to consider this issue.

3.5 Science Communication

a) Introduction

Background Information

As scientific research has become more specialized and diverse, its communication has become less accessible both to the public, to policy-makers and to other scientists who are not directly involved in the specific discipline. At the same time, the increasing need for science-supported decision making, greater relevance for scientific research to social priorities and the enhanced awareness for more transparency and greater public accountability for science, all reinforce the need for more intensive efforts to improve the effectiveness and scope of science

communication. It has become clear that scientists need to take more responsibility to disseminate the main outcomes and ideas from their research more effectively. It has also become clear that this will not be enough: there is a also a need to develop mechanisms for the public and the interested professional to engage more with scientific awareness activities and at the same time there is a need to promote professional training and practice in science communication as a specialized discipline.

Specific context

Activities in the area of communication developed within Science and Society in FP6 could build on relatively few experiences developed at the EU level within FP5 (Raising public awareness). Other experiences were available mostly at the national level, but with a relatively low degree of funding or EU networking. The Science and Society Action Plan focused on the problem that science communication activities were fragmented all over Europe: a number of science weeks and festivals of good quality in many cities and regions had only local impact with no systematic partnerships between them and no clear structure to exchange best practices; science events professionals lacked a forum for setting up partnerships and interactive exhibitions or information products on science, hardly circulated in Europe due to the transport and translation costs involved. The main objective of the Science Communication programme was formulated in terms of bringing the general public closer to scientists and science through direct relationships with a long-term goal (to change the science and scientists image, to encourage scientific careers) and a favourite target (young people). The Science and Society programme supported a number of pilot activities at the European level, e.g. European audiovisual co-productions on science for the general public. The outcome of these pilot activities is now a basis for reinforced or reoriented activities in the FP7 work programme.

Objectives

Relevant general objectives in the Science and Society Action Plan included "promoting scientific culture in Europe", making people "more familiar with science and technology", "give science and technology a higher profile in the media in Europe". The specific focus of the work programmes included: "setting up working groups and networks to exchange experiences between the scientific and media communities, and with science communicators", "impact analyses of activities for raising public awareness of science at the European, national and regional levels" (2003); "actions to promote an interchange of scientific information products for the general public (e.g. travelling or permanent exhibitions, documentaries) between European countries" (2004); "support to TV and radio productions on research and science" aimed at "members of the public unfamiliar with research and scientific issues, including young people"

(2005); “measures for improving the exchange of experiences and resources among organisers of national science weeks to enhance their European dimension and added value”.

Activities

22 projects were funded in this area. Other relevant activities in this area include conferences like the European Science and Society Forum (2005) and some initiatives within the CREST clusters. Descartes prizes for research and science communication - established respectively in 2000 and 2004 to reward outstanding scientific achievements through trans-national collaborative research and exemplary action in science communication - were also considered in this area.

b) Assessment

1) Are Science and Society activities in line with the three missions of Directorate C?

Activities conducted within the Communication thematic area appear generally in line with the specific mission of raising the profile of European research and science. However they still fall short of the wider contextual need to develop a bidirectional communication between science and society and also to diversify the channels for more effective science communication.

2) Issues of scale

The budget size appears in general appropriate to the ambitions of activities carried out in this area.

In terms of the relation of activities’ time frame with regard to the objectives of activities, significant concern has been expressed by the Review Panel about the high uncertainty about the sustainability of projects in the area of communication after the end of the EC funding period. While event-based initiatives are by their nature circumscribed in terms of time, some of those organized in this thematic area would have lent themselves to the planning of preparatory/ex post facto activities that would have extended both their time frame beyond the specific event and helped emphasize their connection with other activities, as well as with the Action Plan general aims. A positive example, in this light, seems to be represented by the Science in Society Forum, where the final event was prepared through activities in six Member States, thereby also broadening and deepening the participation of several relevant actors.

3) Issues of specificity

While many of the activities appear reasonably well focused in terms of the topics specified, an issue nevertheless exists in terms of overlapping of some initiatives’ aims and methods. A certain degree of overlapping and lack of integration is to be seen also between some of the

activities promoted within the CREST cluster initiatives and other specific projects, networking initiatives and expert groups.

There is a need to broaden the activities beyond events for promoting awareness in order to cover the development of structures for accountability on the part of scientists and also capacities for more professional expertise in science writing and communication.

4) Coverage of transversal issues

Coverage of transversal issues, coordination and integration of activities performed in this thematic area with those carried out in other thematic areas emerges as a crucial issue in view also of the thorough coverage and implementation of the three missions of the Science and Society Action Plan. Difficulties in terms of integration emerge at several levels.

At a more specific level, it seems that opportunities could have been better exploited, for instance, to incorporate results of funded projects into other initiatives/materials (e.g. conference materials, booklets) in this and other areas of Science and Society. Vice versa, some projects and initiatives strictly linked to communication themes, also in neighbouring thematic areas of Science and Society seem largely to ignore the existence of other materials/clusters/guidelines with inevitable effects of duplications - and sometimes even contradiction.

At a more general level, a rather sophisticated way of addressing Science and Society issues by some initiatives and expert groups does not always reflect on the practical level, with some communication initiatives and materials still apparently grounded within the limits of a deficit, paternalistic model of science communication. Thus, on the one hand, fairly advanced forms of citizen engagement in science and technology decisions and issues of co-production in research (between experts and patient associations, for instance) are explored and tested; on the other hand, several projects funded in this area appear largely to adopt a top-down, pedagogical approach in which the audiences are meant to passively appreciate and acknowledge the achievements of researchers. This could not represent a major problem per se, since it is reasonable that different themes/areas (and even different national/cultural contexts) may require modular approaches to the expert/non expert relationship as well as a broad range of models and tools; however, it would be important to have at least an overarching rationale or conceptual framework to avoid the potential impression of plain contradictions between initiatives. As was already noted by the Review Panel, implementation of the Plan would have benefited from a more intensive integration among areas and priorities that may also better reflect the concrete needs of relevant actors and stakeholders – for instance, addressing science communication issues in connection with gender issues.

Finally, a question of integration/coordination should be raised with respect to the activities/initiatives of other directorates, particularly with regard to themes like the life sciences or nanotechnologies in which the communication dimension appears extremely relevant.

5) Assessment of the policy relevance

Activities in the area of communication seem, in principle, to be able to achieve significant policy relevance, in particular with regard to the European added value. However, many of the efforts done so far – particularly with regard to funded projects as evaluated by the first group – seem to be aimed primarily at communicating to the general public and raising the profile of European science. While this is certainly a key target, the issue of making researchers more aware of the need to be accountable in the face of non experts appears not less relevant.

6) Potential impact on "policy environment"

From the statistics on requested contributions and countries' participation to the Science and Society programme calls, this area of the programme seems to have achieved a significant impact in terms of eliciting a broad involvement of actors and institutions across Europe, stimulating networking and fruitful exchange. However, it is not always possible to assess the actual impact of the specific activities conducted with regard to their relevant audiences/levels - which brings to the light what could probably be regarded as some of the most crucial and problematic points of many activities/initiatives in this area.

- In the first place, unsystematic attention has been paid to the aspects related to the dissemination of results and products - something which had been boldly remarked by the Review Panel also with regard to most of the funded projects. This includes an issue of identification and reaching of relevant audiences: policy-makers (including EU level policy-makers, but without neglecting national and local policy- making, stakeholders, NGOs, citizens…)

- While communication activities within FP6 were aimed primarily at action rather than research, their potential might have been enhanced by a stronger emphasis on dialogue between theory and practice of communication, which appears increasingly crucial in this field. The importance and feasibility of such dialogue is highlighted by examples – although not strictly within FP6 – like the magazine RTD Info, which seem to have brilliantly fostered interaction among different audiences (e.g. scientists, policy-makers, media actors).

- The Descartes Prizes' award ceremony is conceived as an event highlighting for the public the achievements of the laureates and the impact of their work on the European society. Both Descartes prizes have reached their objectives (they both contribute to

"Europeanising" research) but the impact of the award ceremony is probably insufficient.

- Finally – and at least partially accounting for the above mentioned weaknesses – there is a lack of elaboration of consistent and shared indicators at the European level, against which the impact and effectiveness of science communication activities can be thoroughly assessed. Such indicators should go beyond a mere quantitative dimension. This problem reflects both on the level of specific communication projects as evaluated by the first panel and on the level of background activities.

7) Evolution

An evolution on the way communication issues have been dealt with is evident in many activities - particularly those which have been carried out across several years and multiple stages. Promising new directions and levels of action are also being recently explored – e.g. stimulating science communication at the local level of municipalities within the EU context. Still, it can be argued that further efforts could be made to take stock of the many important results/achievements/materials of the activities and to feed them back into relevant policy documents like calls for proposals.

c) Recommendations

1. First and foremost, the need appears urgent to elaborate and validate a set of robust indicators for assessing the impact and effectiveness of communication (and more in general, science in society) activities/initiatives at the EU level. Such indicators should not only be validated in their relevance and consistency by scholars and practitioners, but should reflect as far as possible the multiple points of view of relevant actors and stakeholders, including minorities and vulnerable groups.
2. The importance of the dissemination issue should be emphasized. This does not only mean extending the target audiences in terms of number, but also devoting efforts to identify relevant audiences and circles – particularly in the area of policy- making – for each specific initiative.
3. An issue of dissemination exists also in relationship to the two Descartes prizes, which represent an interesting and useful initiative and they have both to be maintained with the label Descartes. Increasing the financial amount of the research prize would be desirable in order to allow the winning teams to develop their cooperation.

The award ceremony should be reappraised with a double objective: explaining what has been achieved by the laureates and organizing debates on present and future scientific challenges and on Science and Society issues. It should have a better visibility in order to reach, through the media, the public as well as policy- makers.

4. Beyond providing practical tools, boxes of "communication tricks" and funding opportunities to researchers and their institutions to communicate with the wider public, further efforts should perhaps be devoted to stimulating a broader awareness – among researchers and their institutions, their funding partners etc. – of their increasing responsibility to be not only proactive in publicly promoting their research, but also transparent and accountable in the face of citizens' concerns (as outlined in documents like the EU Charter for Researchers).

5. Continuous attention should also be paid to the importance of integration at several levels:

   - *among different categories of actors* active within the thematic area of science communication (scientists/media, scholars/practitioners, public/private/NGOs);

   - *across thematic areas* (between communication and governance, ethics, women and science);

   - *across actions/initiatives of other directorates* (e.g. communication issues with regard to life sciences, nanotechnologies..).

   This could, among other things, reduce the risk of duplication of similar activities and reciprocally reinforce the impact and added value of interrelated initiatives.

6. Finally, more thorough integration and cross fertilization should also be continuously sought and monitored in terms of the relationship between the level of conceptual innovation and critical reflection on science communication that results from expert groups or workshops and the models of science communication that are incorporated in other activities/initiatives/ products/materials. Increased Attention should also be paid to a better coordination between national activities in order, in particular, to facilitate the exchange of views on interesting and innovative experiences in the area of science communication activities and also encourage jointly organized initiatives in cooperation with the EC. In this perspective, the role of the CREST committee should be reappraised.

3.6 A brief note on Scientific Culture

Background information

The extent to which a society celebrates the achievements of intellectual creativity and is also aware of the powerful potential of making use of scientific expertise and know-how in making choices and formulating decisions, is an issue of scientific culture. The scant measurements of the public understanding of science, and the widespread room for improvement that exists, in both the public transparency for science and the accountability of scientists, lead to a situation where there is a need for belligerence in safeguarding scientific culture within European society.

In the knowledge society, science is accorded a special intellectual prominence, a privileged position. The basic premise for this is that science is the only available means for developing reliable knowledge. Are there limits to the application of this presumption? These are certainly issues which might be addressed in the frame of a programme. Restricting the capacity to reflect in this area contributes to two shortcomings: it contributes to the popular lack of understanding of the role of science and technology in society; it also makes science pervasive and ubiquitous with the possibility that we do not sufficiently explore the limits of science thus exposing ourselves to (i) risk and (ii) waste in resources.

Additionally, there exist conflicting views about the development and nature of scientific knowledge (for example those developed by post-modernist lines of thought) and its relationship with its social and economic context. These are also issues to be addressed.

Recommendations

There is a need for more intensive and coherently formulated activity to both study and promote scientific culture.

Philosophical, historical and cross-disciplinary aspects of scientific development, including its relationship with arts, could usefully be promoted within such activities. Transversal projects with Science Communication could also lead to more innovative approaches for celebrating science as part of human cultural creativity and hence afford it the place it deserves in the popular public sphere.

4. Overall Assessment of the Science and Society Programme

4.1 Achievements

A markedly broad range of activities have been performed: 150 projects involving various partners, as well as conferences and debates. A number of figures provide an overall picture of the importance of partnership (teams from various national institutions) engaged into the programme.

The programme attracted a large number of participants: 916 partners from the EU25 were engaged in projects with 764 (73% out of total of 1045 participants) from the EU15. Additional partners came from associated countries such as Switzerland and Norway as well as third countries such as Canada and the USA. The participants were predominantly from the public sector with higher education institutions (41%) and research institutes (23%) holding the largest share; participation from the industrial sector (public and private) has been rather modest ranging from 0.5% to 6% across the five thematic areas. The distribution of partners among EU countries has been rather even with the larger shares of participation from 4 large countries: France, Germany, Italy and UK had 45% of the participating partners, a figure which is nevertheless far lower than their share (65%) in the R&D funding in Europe. Participants from new Member States have been rather fairly represented (with the exception of the areas of Scientific Advice and Governance and Ethics) although the funding for their participation in the projects appears to be determined more commonly by the perceived cost of labour in these countries rather than the work involved.

The total funding for the Science and Society programme in FP6 was 71.5 M€. This was distributed among the five thematic areas of the programme: Science Education (including Scientific Culture and Descartes prizes): 24.3 M€ (34.1%); Science Communication: 5.3 M€ (7.4%); Scientific Advice and Governance: 4.7 M€ (6.6%); Ethics: 24.9 M€ (34.9%); Women and Science: 12.1 M€ (17%). In terms of funding, Ethics, Education (but including substantial funding for the Descartes prize) and Women and Science have received a relative priority. The types of funding instruments used were fairly evenly distributed. Coordinated actions represented 24% of the funding of activities, specific support actions 56% and specific targeted research 20%. For the vast majority of projects, the funding was at a relatively modest level (below 0.5M€). Although one might fear that a rather large scattering of the distribution of funding among many projects would be detrimental to the quality and focus of activities on meeting well identified objectives, we have considered that, in this case, launching 150 projects with many partners has worked positively in catalysing the involvement of new actors in a diverse range of important activities.

The achievements of the programme are real and numerous and in line with the mission and main priorities defined by the Action Plan. We have considered that all the activities have contributed to its implementation. The actions that have been performed have in most cases produced significant results (although for several of them it is still too early to provide a clear assessment of final outcomes and achievements). Based on our analysis, the main positive achievements of the programme are the following:

- All projects have generally succeeded in creating networks of partners who have been able to achieve common goals, to exchange and share experiences and to demonstrate an European added value by contributing to the emergence of communities in Europe that are seeking to address issues related to the complex roles of science in society; furthermore the programme has triggered activities in countries where they were not yet apparent and it has thus partly achieved its objective of catalyzing the involvement of academic communities from new Member States in Science and Society activities.

- Conferences and forums were able to launch debates in several areas (scientific culture, women and science in particular) at European level with a rather large participation from a diversity of actors. They have doubtless contributed to enhance the visibility in Europe of important issues in areas such as ethics, women and science and scientific communication and have also provided pilot examples of methodologies for how to achieve this in a broader spectrum of issues.

  The Descartes prizes have also made a significant contribution in highlighting the importance of (a) European cooperation to achieve excellence in research and (b) science communication activities.

- The programme has established a very visible European dimension for Science and Society issues in a manner that provides reflective activities on specific issues related to scientific and technological research (such as Ethics, Governance and Science Communication), as well as a thoughtful scientific approach to highlighting and addressing barriers and future obstacles to the continuing contribution of science in society (such as the challenge of safeguarding a sufficient supply of competent future scientists and engineers and the need to enhance the involvement of women in science). Some of these issues continue to be of crucial value to the Lisbon agenda (Science Education and Scientific Advice and Governance, in particular). The programme has also served to highlight important themes such as science and natural risks, which deserve to be addressed more consistently in the future.

- The programme has made important contributions in enlarging the circle of communities involved in such kind of activities at national level (with the biggest impact made in new EU

Member States) and has provided increased visibility for these activities both among scientists and among the public.

- In several projects, new partnerships were engaged at the European level (local administrations, science museums) to address issues related to culture and education, thus enlarging the circle of partners to non-academic communities.
- Several projects involved non-European partners (for example, African countries in the Ethics theme) which has provided a valuable international dimension to the programme and has laid the foundations for more intensive future collaboration efforts with potential for enormous impact.
- The programme has mobilized a rather impressive number of experts at various levels (advisory board, evaluation panel, etc.) In this context, the Commission services have acted in a commendably open manner in implementing the Science and Society Action Plan and contributed through its communication service to highlight several important issues, which it addressed. The Advisory Board, the Expert Groups and the various studies that were undertaken have provided valuable input in designing a policy and also modifying it along the way in the light of both new information and the response from the various actors.

Our assessment has also identified a certain number of weaknesses in the implementation of the programme, which, are mostly apparent across all of the five thematic areas that we have assessed:

- The scope of several projects, and possibly of the work programme, was too narrowly defined. This was particularly the case for the themes related to Scientific Advice and Governance, Scientific Culture, Ethics, and Women and Science). Furthermore very few, if any, of the projects were able to address “transversal “issues (such as ethics and governance or gender issues in science education).
- Scientific culture issues were addressed in the work programme only through the science education and science communication strands (with the exception of one project which innovated in its approach as it involves city administrations in charge of scientific culture activities); this focusing may have been an obstacle to an enlargement to activities at the border between science and other dimensions of culture (such as the Arts, for example).
- In some areas, few innovative tools or actions were launched by participants to projects: the approaches for communication and scientific culture remain largely “classical”, for example.

- The participants were predominantly drawn from academics with actors from industry, public administration, the media, NGO's and, in general, policy-makers playing a more minor role.
- Many projects have considered the dissemination of their results and findings as a secondary activity: this is a serious handicap for the overall impact of the programme.
- The absence of committed policy-makers among the partners and of active dissemination practices has probably weakened the impact of the programme.
- The perennial character of the activities of partners engaged in projects is not guaranteed as there does not exist, in general, an action plan for important follow-up activities or for sustainability measures. Impact on policy development is severely constrained because of this factor: there is a strong need for new mechanisms to broaden, where appropriate, the commitment of participating institutions beyond the facilitation of activities in order to take on board the responsibility to make policy changes.
- For the most part, other Directorates of the Directorate General for Research and other Directorates General of the Commission appear to have remained distant observers to the Science and Society programme. The notable exception is DG Fisheries, which had an activity with serious involvement in the programme. This could be deemed as a pilot effort from which lessons can be drawn as to how to involve other directorates more meaningfully. Their support will also influence the long term sustainability of this important programme.
- The coordination with national activities in the Science and Society domain has not been achieved to any noticeable extent. The Open Method of Coordination has not brought significant progress in this direction, partly because the CREST committee has not played a proactive role in this perspective. The Science and Society Programme Committee has not taken sufficient initiative in this respect and the National and other Funding Agencies have, in the best of cases, taken only a very fragmentary approach to policy development and implementation on these issues. There is little evidence of synergies between activities at national, regional and European levels.
- The Cluster implementation by Member States was patchy. In practice, some clusters were more active than others and most efforts did not survive the test of time. However those that did (such as the Helsinki Group that evolved from the Women and Science Cluster) appeared to do so because they were filling a void in existing communities and, made important contributions to the evolving priorities of the Science and Society programme itself.

- There is a discrepancy that can be recognized between EC funded activities and those that are organized with the approach of the Open Method of Coordination (OMC). In the first case, the institutions that participate are those that have identified internally the incentive of gaining from the support of external funding for activities that fall within the sphere of the institutional mission. In the second case, participation is more commonly through institutional structures that have taken on the responsibility of representing Member States to the European Community. As a result, the general perception from participants in EC funded activities is that they act as lone operators (independently of the policy-making structures inside their institutions) implementing externally funded projects for the purpose of realizing specific activities. In the second case, the perception from participants in OMC initiatives is that they are engaged in exercises with no funding for activities. Their contribution is perceived to be on top of already heavy schedules, often in a line that is disparate with their every day work. The end result is that in both situations (EC funded and OMC-type activities) the link with policy-making is simply not there: in the first case of EC funded activities, participating institutions commit to them as extraneous activities that are not linked to their current or future policy evolution; in the second case because it is a hit and miss exercise on the part of the Commission to work with colleagues from the Member States that are at the right level in the hierarchy, in roughly the right area to influence policy-making on the issue at hand. Hitting the right level in the hierarchy so that access to both expertise and policy-making power is less of a hit and miss process becomes further complicated due to the widespread lack of understanding in the rationale behind EC policies and activities, among many institutions at the level of the Members States.

  Resolving this problem needs a multi-faceted approach: where there are aspirations in the Science and Society programme to influence policy development, this needs to become more explicit and there is a need to link external funding to institutional commitment for policy development, not just activity implementation. There is an additional need to highlight examples of successful practice and/or fund benchmarking exercises on policy influences of EC activities. Lastly, there is a need to transfer expertise from EC to national institutions in participative policy-making procedures.

- There is a need for the European Commission to internationalize its Science and Society activity. Building new capacities to work with developing countries in Africa and the Middle East can be a very productive activity in fields such as Science Ethics. There is enormous potential to work with and influence local structures (under admittedly many difficulties and severe constraints), as demonstrated by the seed activities that have already been undertaken, but also to obtain experience with innovative applications in a diversified context which then provides extremely valuable feedback to policy-making with respect to, for instance, the

medical profession, the pharmaceutical industry, the food sector and water engineering. There is also a clear opportunity to enhance this capacity to build a European competitive edge in developing countries while at the same time exploring new ethical and policy–related issues.

4.2 Impact in relationship with the objectives of the Action Plan

The Science and Society programme was defined and launched as a means for the European Commission to realize its contribution in implementing the objectives of the Science and Society Action Plan and to catalyze associate activities by other actors. All the funded activities have been in line with the objectives of the SASAP as defined in 2001 and subsequently refined to achieve complementarity between calls and greater effectiveness along the way. The programme's capacity for promoting the European dimension of Science and Society issues is beyond any doubt and it has contributed significantly in raising the profile of these issues (in science and in society) and also in enlarging the circle of communities involved in this type of activities at national level, with the greatest change appearing in the new EU Member States. The actions have also served to enhance the visibility of science in society, an achievement that has also been pointed out by the evaluation of the Science and Society Action Plan performed by The Evaluation Partnership in 2005. Because this was a "mid-term" assessment exercise, we lacked information on the final results for the majority of the projects which we reviewed since most of these were not yet fully completed. Despite this, it is possible to identify some trends and inadequacies: the policy impact of the programme is probably insufficient since: the circle of actors involved was too narrow (participants pertained in their great majority to the academic community); the dissemination of results was often restricted with a general lack of specific actions devoted to communication of outcomes; the response of policy-making institutions at national level appears to be rather disappointing. These three factors are a serious handicap, and efforts need to be undertaken to remedy them in a new programme under FP7. Furthermore there did not exist any "feedback" mechanism which would have allowed the introduction of various findings and innovative experiences in the policy-making mechanism both at European and national levels (a project on scientific expertise in fisheries management is probably a possible exception as is *SINAPSE*, an expert database which can evolve into a very useful tool). This might probably constitute another kind of obstacle to broadening the impact of the programme.

4.3 Lessons from the implementation of the Programme

There are a few specific lessons, which can be drawn from the strengths and weaknesses of the programme.

The programme was defined as the EC's contribution towards implementing the Science and Society Action Plan and research activities, as such, were not a priority among the objectives of the programme, although research issues were integrated into the work programme in its latest version. Meanwhile, it appeared to us that the knowledge base for the activities in some areas was probably insufficient. Research activities can also serve to provide reflective and monitoring mechanisms in all end-oriented actions and this was perhaps not appreciated as an important issue. For example, it is necessary to persist with the need to understand better how the assessment culture impacts on science teaching and learning, how various minority groups engage with science education, how new innovative tools can be used in science education and culture; it is also important to launch studies on institutions and their contribution to the Science and Society dialogue (political institutions, national research institutes and universities), on the role of new media (internet for example), and to undertake historical analyses on the impact of specific disciplines on scientific culture as well as philosophical studies on the interplay between science and cultural creativity. Broadening the scope of a future programme to research activities in order to include research, as well as foresight activities, will be both important and useful.

A greater effort needs to be devoted to the improvement of the dissemination of the outcomes of the programme, including the results and findings of individual projects. There is room for improved support by the Commission Services in specifying more effective dissemination strategies. There is also a strong need for follow-up activities undertaken by the Commission, in cooperation with the partners, in order to organize targeted dissemination of the achievements of projects.

There is a strong need for coordination with national and localized activities in the various areas of the programme. In this perspective, the role of the CREST committee should be reappraised. Greater effort needs to be devoted in engaging national funding agencies and policy-making institutions in an effort to achieve planned complementarity and greater coherence. A renewed emphasis on developing participative methodologies and specific indicators would also be of benefit in this respect. Our panel has missed specific indicators to assess the results of the programme activities. This is also a serious handicap, which should be corrected in the future, although we are conscious that the production of well defined indicators is a difficult task.

5. Recommendations

Taking into account our main conclusions concerning the overall achievements of the Science and Society activities performed during FP6, with their strengths and weaknesses, we would like to propose the following recommendations for a renewed "Science in Society" programme in the context of FP7:

The perspectives of the programme could benefit from being broadened in two ways. First, to correct for instances where the programme focused its objectives too narrowly (Science Communication and Scientific Advice and Governance, respectively). Second, there is a need to include new topics, such as actions addressing "transversal" issues and to reinforce the contribution of research activities (particularly in the social sciences) to the programme in order to strengthen the knowledge base that is deemed necessary for the actions.

> *For example: (a) issues of ethics and gender could be usefully addressed in different thematic areas (governance being one of them, science education another one); (b) understanding how young people develop a participatory role in various kinds of media (such as the internet) is important for launching innovative actions in the domains of scientific culture and science education; (c) how broadly are scientific expertise and advice being defined? What is their role in the policy-making process? - What innovative methodologies can be used to integrate scientific expertise, social priorities and public thinking in science and technology policy development? (d) Foresight activities could also be included in the programme in relation with the future of the European Research Area (for example studies about the impact of a new dialogue between the scientific community and the public on the future evolution of scientific institutions).*

More intensive activity needs to be undertaken in the area of Scientific Culture in order to (a) develop a better understanding of the role which science should play as an important part of human culture; (b) envisage new channels for a better dialogue between scientists and the public, which should involve enhanced innovation in engaging a diversity of actors, including the public, in science-related debate; (c) promote innovative methods for the public accountability of science, including its ideas, its methods and the quality of its outcomes, and (d) demonstrate more effective approaches to better integrate Science into publicly visible Creative Culture.

There is probably a growing gap between science and other dimensions of culture (philosophy, arts, literature, etc.) and launching activities at the border between science and those dimensions might contribute towards better understanding and perhaps closing this gap. There is a clear need for more consistent examinations of scientific issues from philosophical and, historical perspectives as well as explorations of the parallel development of ideas in the Arts and Sciences (through projects, forums, cultural events, etc.) in their European dimension.. In the same perspective, identifying and sharing experiences in the reappraisal of the role of science museums in Europe would be valuable. Exploring the possibility for joint projects with UNESCO and foundations would also provide useful platforms. The RDT Info magazine of the Commission could constitute one channel for disseminating information on scientific culture issues in their broad dimension.

The diversity of partners involved in the various activities should be broadened so as to include academics, representatives of private companies, NGO's and, whenever possible, policy-makers in the public sphere (administrations, parliaments, etc.), as well as the private sector (industry, services and foundations) and the media.

The impact of the programme will increase in so far as various partners at different levels of the policy-making process will be involved at least at some stage of the activities.

It is important to extend partnerships beyond academic circles in order to enhance the visibility and strengthen the impact of the programme. Incentives should be explored for extending the activities of the programme to industrial partners as several issues have a strong "industrial dimension" (in the areas of health and ethics, Women and Science and science education, for example).

A greater effort should be devoted to the improvement of the dissemination of the outcomes of the programme, including the results and findings of individual projects. There is room for improved support by the Commission Services in specifying more effective dissemination strategies. There is also a strong need for follow-up activities undertaken by the Commission, in cooperation with the partners, in order to organize targeted dissemination of the achievements of projects.

New initiatives in the various areas of the programme, renewed efforts at benchmarking of experiences existing at national levels, innovations in science communication, education and culture, etc. should be more widely publicized. Cooperation with the media is probably important in this perspective; involvement of science museums and the award ceremonies

for the Descartes prizes might constitute additional useful tools. In many cases, the programme could benefit from follow-up activities to many of the projects and the Commission could usefully undertake initiative and also devote financial means to catalyse this process, at least in its first stage.

There is also room for improvement in the extent to which the Commission co-ordinates its relevant activities in different Directorates. The issues of Science Communication and Scientific Advice and Governance need to concern most Directorates within DG Research. There is also a clear need for creating a feedback mechanism that will use the outcomes of the programme specifically to enrich the various advice and decision-making processes at different levels of the science policy development enterprise, including the various EU levels and the institutions involved at the level of Member States.

Many, if not all, thematic areas are of direct concern for a broad range of EC activities (in research, education, various public policies including norms, regulations and intellectual or industrial property rights). Channels should be found to introduce results from the programme into as many of these activities as possible. The "embedding" of several Science and Society issues, in other parts of the FP, should also be further promoted, whenever possible.

There is a strong need for coordination with national and localized activities in the various areas of the programme. In this perspective, the role of the CREST committee should be reappraised and new mechanisms need to be found in order to safeguard increased commitment to relevant home policy development by the actors that are involved in the various co-ordination activities. Greater effort needs to be devoted in engaging national funding agencies and policy-making institutions in an effort to achieve planned complementarity and greater coherence. A renewed emphasis on developing participative methodologies and specific indicators would also be of benefit in this respect.

All the issues of the programme are embedded in national activities (Science Education policy, access to scientific expertise for the government, ethics, etc.) and sharing experience in these domains as well as finding common ground for at least some reform will be important.

For example, there is room for developing common understandings of the reasons behind the lack of attractiveness of scientific education in most Member States, as well as

identifying new ethical issues. In this perspective the CREST could play a more proactive role.

The effort to link Science and Society activities with policy development through synergies at European and national level will need to overcome some barriers. The biggest of these is a general lack of EC activities as opportunities for valuable policy development in these areas. Where there are aspirations in the Science and Society programme to influence policy development, this needs to become more explicit and there is a need to link external funding to institutional commitment for policy development, not just activity implementation. There is an additional need to highlight examples of successful practice and/or fund benchmarking exercises on policy influences of EC activities. Lastly, there is a need to transfer expertise from EC to national institutions in participative policy-making procedures.

EC funded activities are perceived in many institutions as externally funded fringe projects with no commitment for linkage to internal policy development activities, which would require much stronger, management-level, institutional commitment, in any case. There is not yet in Europe an efficient mechanism to identify and launch initiatives in multi level policy development, as is clearly needed in relationship with Science and Society. Broadening the ERANET mechanism might possibly lead to an avenue for resolving this gap.

An effort should be undertaken both by the Commission and National Contact Points (particularly in the new Member States) in order to make the information on the objectives and ongoing activities of the programme more widely accessible and to promote the participation of a broader diversity of partners in the programme.

Dissemination of the information regarding the programme's activities is probably insufficient in several new Member States; this is a handicap both for their involvement in Science and Society activities and for the integration of corresponding issues in their national research strategy. The Commission might also play a more proactive role in involving new participants who could bring broader and more diverse approaches to the activities. Many of the issues addressed by the programme have a broad international dimension beyond the EU. Efforts to co-ordinate more closely and to exchange expertise with corresponding activities in the US and Canada would add value to the programme. More broadly, the Commission should more actively encourage an internationalization of its Science and Society activities. On the one hand, on issues such as Science Education or

Scientific Advice there is room for productive exchange of expertise and experiential insight with Canada and the US who share similar concerns and have parallel extensive ongoing activities. Even more importantly, Europe has international interests and a mission that can only be realized through building new capacities to work with developing countries in Africa and the Middle East. The exceptional projects that have tried activities in Science Ethics demonstrate the enormous potential to work with and influence local structures (under admittedly many difficulties and severe constraints) but also to obtain experience with innovative applications in a diversified context which then provides extremely valuable feedback to policy-making with respect to, for instance, the medical professions, the pharmaceutical industry and the food sector. The Science and Society programme can take a pioneering role within the FP7 in developing this capacity to build a European competitive edge in developing countries while at the same time exploring new ethical and policy-related issues.

There is a need to re-examine the criteria that are applied for the evaluation of proposals. Criteria should include among others (quality being of course the primary one): (a) a detailed plan for dissemination of results and findings with a description of specific means; (b) the European added value of a project and its contribution to the emergence of a community dealing with specific Science and Society issues.

Evaluation should take into account the potential capacity of any project to have an impact on practice related to the corresponding Science and Society issue. The mechanisms for dissemination of the results are critical from this perspective.

A specific action to produce a limited number of specific, substantial and robust indicators should be undertaken as they would be useful tools (among others) to assess the results of the programme, as well as the sustainability and long-term impact of funded activities.

The lack of a sufficient range of valid indicators is probably a handicap in any effort to assess the impact of many of the activities of such a programme. Such efforts should be defined in cooperation with Eurostat and national agencies that share the same needs. Gradual development work in this direction will make future assessments more informative but will also facilitate a feedback effect in raising awareness among policy makers of the importance of these activities as well as the somewhat problematic background in terms of attitudes and public accountability in the context of which the program is operating.

6. Conclusions

The launching of a "Science and Society" programme was an important initiative undertaken by the Commission for implementing its Science and Society Action Plan during the FP6, and thus for addressing issues which are central to the new relationships between research activities and society. This programme, by its very existence, amounts to an innovation in so far as it has the main objective of engaging various communities in EU Member States in common activities in this area for the first time in a Framework Programme. The most important achievement of the programme was its capacity for giving a real European dimension to ongoing Science and Society activities in several countries but, also, for providing a new impetus under which to unify a range of emerging issues about the complex role of science in society, in several EU countries.

The relationships between Science and Society have continued to evolve since the EU Member States had decided, in the year 2000, to create a European Research Area as the main cornerstone of the Lisbon strategy. Scientific and technological developments in biology and medicine, with their potential impact on human health as well as the evolution of health systems in Europe in the face of an aging population, are bringing to the forefront new ethical questions; Climate change with its potential impact on living conditions and ecosystem dynamics on Earth is raising new questions for which scientific advice and expertise need to continue to play a critical role; The evolution of urban environments and the various issues related to employment are creating new challenges for science, and enhance the need to embed a more informative societal dimension and also strengthen the social science methodologies in the coming years. Furthermore, in the perspective of the emergence of a knowledge-based economy, the future of Europe depends, much more than in the past, on its capacity of mobilizing scientific talent and of encouraging a strong and intensive scientific culture. Recent reports on science education and scientific careers (such as the Gago report *Europe needs more scientists,* in 2004, and the OECD report *Evolving Student Interest in Science and Technology Studies* in 2006 [18]) have stressed the necessity of understanding the reasons behind this phenomenon and finding new means for encouraging the young generation to engage more with scientific education and careers. In the absence of an active science education policy, Europe might face a shortage of scientists and engineers in the near future.

Strengthening the basis of a knowledge-based society in Europe requires creating new dynamics and a new relationship between science, research activities and society. Hence there is a need for

[18] OECD Policy Report, *Evolving Student Interest in Science and Technology Studies*, March 2006 (see at: http://www.oecd.org/dataoecd/16/30/36645825.pdf)

a reappraisal of the institutional links between research and society in order to enlarge the dialogue between the scientific communities, representatives of society and more largely the public, to better integrate science into cultural creativity and to make science more visible as an integral activity of human culture, thereby facilitating a broadening of the constituency for science and technology.

The scope of Science and Society issues has been formulated since the publication of the Commission's Action Plan, which set up guidelines and objectives for a specific EU programme dedicated to these issues. The positive achievements of the first "Science and Society" programme clearly demonstrate that a renewed "Science *in* Society " programme during FP 7 with a broader scope could and should contribute towards bringing a necessary European vision to the construction of a new relationship between science and society with the collaboration of partners beyond European shores ([19]).

[19] See also: EURAB Report, *Science and Society: an Agenda for a responsive and responsible European Science in FP7,* September 2005 (available at http://ec.europa.eu/research/eurab/index_en.html)