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The IPTS REPORT

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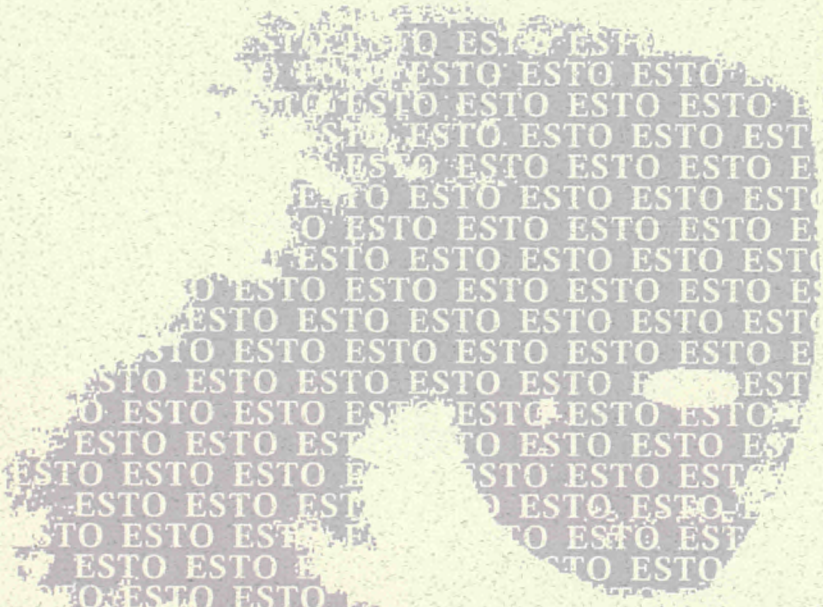

SPECIAL ISSUE: SCIENCE AND GOVERNANCE IN A KNOWLEDGE SOCIETY, CONFERENCE II

EUROPEAN COMMISSION
Joint Research Centre

ENGLISH VERSION

ABOUT THE IPTS REPORT

The IPTS Report is produced on a monthly basis - ten issues a year to be precise, since there are no issues in January and August - by the Institute for Prospective Technological Studies (IPTS) of the Joint Research Centre (JRC) of the European Commission. The IPTS formally collaborates in the production of the IPTS Report with a group of prestigious European institutions, forming with IPTS the European Science and Technology Observatory (ESTO). It also benefits from contributions from other colleagues in the JRC.

The Report is produced simultaneously in four languages (English, French, German and Spanish) by the IPTS. The fact that it is not only available in several languages, but also largely prepared and produced on the Internet's World Wide Web, makes it quite an uncommon undertaking.

The Report publishes articles in numerous areas, maintaining a rough balance between them, and exploiting interdisciplinarity as far as possible. Articles are deemed prospectively relevant if they attempt to explore issues not yet on the policymaker's agenda (but projected to be there sooner or later), or underappreciated aspects of issues already on the policymaker's agenda. The multi-stage drafting and redrafting process, based on a series of interactive consultations with outside experts guarantees quality control.

The first, and possibly most significant indicator, of success is that the Report is being read. The issue 00 (December 1995) had a print run of 2000 copies, in what seemed an optimistic projection at the time. Since then, readership of the paper and electronic versions has far exceeded the 10,000 mark. Feedback, requests for subscriptions, as well as contributions, have come from policymaking (but also academic and private sector) circles not only from various parts of Europe but also from the US, Japan, Australia, Latin America, N. Africa, etc.

We shall continue to endeavour to find the best way of fulfilling the expectations of our quite diverse readership, avoiding oversimplification, as well as encyclopaedic reviews and the inaccessibility of academic journals. The key is to remind ourselves, as well as the readers, that we cannot be all things to all people, that it is important to carve our niche and continue optimally exploring and exploiting it, hoping to illuminate topics under a new, revealing light for the benefit of the readers, in order to prepare them for managing the challenges ahead.

resulting from giving obligations stemming from WTO agreements priority over thematic agreements such as the recently signed biosafety protocol, it would seem to be an opportune moment to turn the spotlight on these issues and their implications.

The goal then in this context is to integrate sound science and sound governance, and to enhance their interface in a way that is accountable, transparent, thorough, impartial and credible, and which will help focus the policy debate on the merits of the proposed actions. Such integration will provide reference quality information and analyses, presenting in a distilled, user-friendly fashion what we know, what we do not know, and the extent of the uncertainties and risks involved in different alternatives.

If strengthening this integration of science and governance is necessary within one country, it becomes even more so when the international dimension of governance is concerned. Across borders there is no unique enforcer, no single government with a monopoly over the legitimate use of force. Hence when sovereign entities have to choose a course of action, persuasion and S/T-informed debate become even more important.

At an even more global level, the absence of an EU-level body acting as an interlocutor and coordinator meant missing an opportunity to nip in the bud what later became thorny EU-US trade problems related to S/T (e.g. approval of genetically modified food products in the US put through completely independently of European attitudes, and future obstacles to their commercialization in Europe).

Both in instances of intra-EU issues in which effective governance has to rely on S/T reference quality information, untainted by as much as the suspicion of possible partiality, as well as in cases of global issues involving the EU with non-EU states, an EU-level system must provide the means of providing EU-wide reference quality information.

Preparing the ground for such a scientific reference system involves more than merely providing advice; the system should engender trust and a sense of shared responsibility through the development of networks, and it should be firmly anchored institutionally. Moreover, it should ultimately combine, and strike a careful balance between, the role of translating relevant knowledge for policy-makers and stakeholders, identifying the common denominators underlying disparate viewpoints, and distilling out the essence of disagreements for subsequent analysis. The Commission's JRC can play a central, catalytic role in this process of building a system for scientific reference.

Such a system could be structured on networks of centres of excellence, catalysed by the Commission, providing a common knowledge-base for S&T reference, and an interlocutor between actors and policy-makers. This would be a crucial step towards tackling the "science and governance" challenge. Moreover it should be seen in the context of, and will be enabled by, Commissioner Busquin's European Research Area initiative, and indeed may serve as a showcase of what this initiative can deliver, when the joining of forces in research that it enunciates takes hold.

To put it in a nutshell, the issue and relevance paragraphs applicable to this entire special issue would be as follows:

Issue: S/T is substantially responsible for driving change; it is a pivotal input to the policy-making process, and can help clarify the terms of the debate, the stakes, and the repercussions of the alternatives considered. Moreover, the pace of change in science and technology has made governments increasingly reliant on timely and accurate S/T advice. However, in recent years public trust has been eroded, particularly where scientists are not perceived as being sufficiently independent from government or other interest groups. Thus, the goal in this context is to integrate sound science and sound governance; to enhance the interface of science and governance in a way that is accountable, transparent, rigorous, impartial and credible; and in such a way as to help focus the policy debate on the merits of proposed actions. Such integration will provide reference quality information and analyses, presenting in a distilled, user-friendly fashion what we know, what we do not know, and the extent of the uncertainties and risks involved in different courses of action.

Relevance: The increasing weight of, and need for, input on scientific and technological considerations for decision-making, creates the need to achieve this in/by "reference quality", consensus-galvanizing ways/procedures that enjoy the full confidence of all concerned. Key to ensuring confidence is ensuring decisions are made in ways that are inclusive of as wide a range as possible of interests and opinions, that are open, transparent and able to handle uncertainty. This would benefit from the creation of an institutionally anchored, common scientific and technological reference system for Europe, making use of existing EU institutional anchors, such as existing Commission research institutions, and the enabling framework provided by Commissioner Busquin's European Research Area initiative.

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Session 1: Science, citizens and the decision-making process

"Two myths that have dominated the past 500 years or so have now disappeared. First of all the myth of constant scientific and technological progress, which it was society's duty to adapt to, without asking questions about its responsibility for giving direction to and humanizing science. Secondly, the belief that science can foresee the consequences of the innovations of which it is the source", noted Professor Bryan Wynne of the University of Lancaster, the rapporteur for this session.

The myth that society is obliged to passively adapt to the unstoppable flow of scientific and technological progress has been exploded

Omnipresent in daily life, displaced from their sacred pinnacle and called into question by a series of scandals, science and technology are at the centre of many questions. How are technological choices made? With what real knowledge? How is the scale of risks evaluated? What is the "cost" of certain scientific advances? Where can we discuss these questions? How can we make our voices heard? Citizens are now demanding to be informed, listened to and involved in choices that they rightly consider as vital.

Different ways of listening

In response to these expectations, certain countries with a tradition of referenda – such as Switzerland, which used this mechanism to address the question of GMOs (genetically modified organisms) – do not hesitate to consult their citizens directly. Denmark has carried out consensus conferences and France has organized citizens' conferences. In the Netherlands, the Rathenau Institute – a national body responsible for evaluating technologies – has been using various participative methods for several years now. A question with ethical implications, for which it is important to gather the opinion of a wide audience, will not, for example, be discussed in the same way as a precautionary principle to be applied in a choice relating to environmental technology. Surveys, referenda and advisory panels are used alongside scientific panels, depending on the nature of the questions.

"We are evolving towards increasingly interactive methods", the institute's director, Josée van Eijndhoven, explained. "Even so, we consider decision-making to be parliament's job and, in the Netherlands, we do not believe that panels of uninitiated representatives can act in the same way as the jury in a civil law court. A direct role in decision-making is not what is essential. What is important is to widen the debate, to take citizens' perspectives into account and to inform experts of the questions uninitiated people are asking and the reasons that lie behind them".

A direct role for citizens in decision-making is not what is essential. What is important is to widen the debate, to take citizens' perspectives into account

In France, Philippe Roqueplo, who for many years has examined the role of expertise in research carried out at the CNRS, and who participated actively in steering the Citizens' Conference on GMOs (1998), has the feeling, moreover, that the general public does not want to take decisions in the place of parliamentarians. However, it does

want to be correctly informed, and for this reason the role of teachers, the media and scientists themselves in the "popularization" of knowledge is essential.

The public wants to know how decisions are taken, and once it does, wants to be able to ask questions and hear the answers rather than be the passive recipient of decisions taken behind closed doors. Mr Roqueplo is in favour of new procedures: public sessions, with debate between the different sides and strict procedures inspired by court proceedings, during which scientists could express diverging viewpoints. This "public arena", to use his expression, would bring certainties – and uncertainties – to the fore, enriching both public debate and the possible directions of research policy.

For a democratic approach to decision-making to work, we need to base it on an idea of co-responsibility between citizens, scientists and decision-makers

"Everyone agrees on the need for a democratic approach, but when we try to deepen the debate to analyse what this term means, it becomes much more difficult", commented Seamus O'Tuama of the University of Cork (Ireland). "We need to review our ideas of citizenship, taking as our basis the idea of responsibility, and in particular of co-responsibility. Each of us is responsible as a citizen, scientist, or political decision-maker".

Scientists and decision-makers need to be conversant with the values held by different groups in society

Learning from each other

The fact is that research – and not only the fruits of research – stands to gain from paying fresh attention to the general public and to the questions non-scientists are asking. The example was given of sufferers from a rare disease organizing themselves into an association and making contact with researchers. For Professor Wynne, "there are times when controversy would have been avoided if highly pertinent questions, asked by non-specialists, had been taken into account from the start of the research. Public participation also goes beyond public opinion. This is a process of learning from each other, which will demand time and commitment if it is to become a two-way communication".

The fact is that scientists and decision-makers need to be conversant with the values held by different groups in society. These are not always expressed clearly, if at all. "This type of exercise nonetheless calls for a certain degree of methodological caution", felt Luk Van Langenhove, deputy secretary general of Belgium's Federal Office of Science and Policy. "Even if examples of good practice exist, social science research is essential to arrive at mechanisms that can secure the success of these new participative methods. These should not take the place of, but be integrated into the way representative democracy currently functions. For example, at Union level, careful thinking is needed into how to involve the European Parliament in scientific and technical decision-making".

Although there has been much talk about involving stakeholders, there is as yet no legal definition of what a stakeholder is

"We have spoken a lot about *stakeholders*," noted Hugh Richardson, deputy director-general of the JRC (Joint Research Centre). "The fact is that there is no legal definition of this term. We must therefore invent new models and procedures that can integrate the various categories of social players, in a representative and balanced fashion, in the governance of science".

As an ambassador and a professor at the University of Montreal, Kimon Valaskakis insisted on the concept of globalization, which is transforming our visions and our values – including those of science and democracy. If we ask ourselves what type of society we want, "we need to balance the desirable with the feasible, with a dose of "real science" and a dose of "real politics" and to distinguish between what can be accomplished at local, national and supranational levels." And, once it becomes clear that we cannot do without global standards, the European Union will be called on to play a major role.

Participants in the Discussion

Chair

Michel Hansenne, Member of the European Parliament, Belgium

Speakers

Josée van Eijndhoven, Director, Rathenau Institute, Netherlands
Seamus O'tuama, Lecturer, Department of Government, University of Cork, Ireland
Philippe Roqueplo, Honorary Research Director, CNRS, France
Kimon Valaskakis, Ambassador, Professor, University of Montreal, Canada

Discussion panel

Thomas Friedrich, Journalist, Bild der Wissenschaft, Germany
Jean-Jacques Laffont, Professor, University of Toulouse, France
Luk van Langenhove, Deputy Secretary General, Federal Office of Science and Policy, Belgium
Hugh Richardson, Deputy Director-General, JRC, European Commission
Mike Segal, Director of Corporate Strategy, Food Standards Agency, United Kingdom
John Ziman, Emeritus Professor, University of Bristol, United Kingdom

Rapporteur

Brian Wynne, Professor, Lancaster University, United Kingdom

Session 2: Anticipating risks: foresight and precautionary research

The precautionary principle is posing complex and new problems for decision-makers and scientists

Scientists are now required to take on board ethical, societal and political parameters, based on non-scientific approaches, and to admit that the work they do carries responsibilities

Several speakers in the plenary sessions referred to the precautionary principle, which has come to the fore over the last ten years or so. Now enshrined in the Treaties as an essential rule of governance in Union policy-making, this principle is posing complex and completely new problems for public decisions-makers and scientists. How can we anticipate and take measures to counter risks, the very existence of which we cannot be certain of in our current state of knowledge? How indeed can we produce the knowledge to remove such uncertainties when scientific activities themselves by definition can only deliver final, undisputed, proofs of impacts looking back in time?

Opening this session's discussions, Christian von Weizsäcker, professor of economics at the University of Cologne (Germany), stressed the complex nature of science's new mission of undertaking "precautionary research". The first obstacle, he reminded delegates, is the difference in time scales that oppose scientific fact – for example, experts are asked to come up with answers concerning the probability and long-term impact of climate change – and the horizons of political and economic decision-makers, who have to take measures at short notice and must justify their actions.

A new discipline is born

Unlike the rigour and precision of science for science's sake (or technology for technology's sake), "precautionary research represents a new discipline which requires scientists to question what they do", according to workshop rapporteur, Uno Svedin, director of research at the Swedish Council for Research Planning and Co-ordination. Scientists are now required to take on board ethical, societal and political parameters, based on non-scientific approaches, and to admit that the work they do carries responsibilities.

In order to move beyond what can at times look like insoluble contradictions engendered by risk anticipation, Professor Arie Rip of the University of Twente (Netherlands), set out a certain number of practical reference points to carry forward the debate. In his view, when it comes to risk, we should stop enclosing science in a reductionist framework in which, to be valid, a scientific opinion needs to be backed up by proof.

Whilst scientific evidence is, of course, necessary and fundamental to the scientific approach, such proof is historical – the result of observations at a point in time to back up facts or a hypothesis about facts. On the one hand, science is constantly evolving and new knowledge needs to be integrated continuously into evaluations. On the other, the precautionary principle calls for scientific opinions about facts and situations that do not yet exist but which could come into play in the future. In the case of the environment, asking for proof is tantamount to not using forecasting models which attempt to plot the future, but to apply a trial-and-

error approach, waiting for the damage to become manifest and then trying to repair it ....

This means that we find ourselves in a process which involves personal judgements, or "controlled speculation", to borrow Professor Rip's definition, which allow us to reduce the degree of uncertainty surrounding the evolution of the problems studied. This having been said, the degree of tolerance to uncertainty can vary considerably: it is probably higher among scientists who are directly concerned by the question, and much less so among decision-makers and legislators whose personal responsibility is involved.

When it comes to the way public opinion perceives risk, this is generally fairly complex. Public opinion has an apparently "fatalistic" approach to road safety, but reacts much more acutely in other cases, as demonstrated by the GMO (genetically modified organisms) debate. The societal and psychological implications of the perception of risk, mentioned several times during this session, remains one of the major challenges to precautionary research.

Public perception of risk is complex and people tend to be more averse to some types of risk than others

The precautionary principle applied positively

Following this path of reflection, Andy Stirling from the University of Sussex (UK), reminded delegates that uncertainty when anticipating risk begins when we are unable to attribute numerical values to the elements of the risk to allow probability calculations. He then went on to stress that, in any event, the results of such anticipation depend on the type of questions asked, the way they are asked, and finally on the interpretation of the answers received. He also pleaded for precautionary research to be carried out in a positive manner, with a view to the benefits of scientific and technological advance, and not just the dangers.

This viewpoint was largely shared by a representative of the industrial world, Erik Tambuyzer, vice-president of Belgian company Genzyme, and chairman of EuropaBio. He used a series of biotech innovations to illustrate the way in which this sector is responding, in an often beneficial manner, to major expectations of society. But in his view, in evaluating risk – which is obviously never totally absent – it is not the job of industry but of society to make decisions, also taking into account cultural or "emotional" values. He felt most business companies are aware of the importance of the precautionary principle and of taking ethical problems into consideration. In particular, they are open to co-operating in setting up a European reference system.

Evaluating risk is a matter for society and not industry to decide upon, and cultural and emotional values need to be taken into account

The importance for Europe of creating such a system (this was the theme of the fourth specific conference workshop summarized below), was stressed by Lena Torell, programme director at the Commission's Joint Research Centre. She raised the question of how precautionary research is to be funded. On this item, Hansvolker Ziegler, deputy director-general at the German Ministry of Training and Research (BMBF), also pointed out that precautionary research depended on the support received from both public and private funding bodies.

Participants in the discussion

Chair

Christian von Weizsäcker, Professor, University of Cologne, Germany

Speakers

Arie Rip, Professor, University of Twente, Netherlands
Andy Stirling, Senior Lecturer and Fellow, University of Sussex, United Kingdom
Erik Tambuyzer, Vice-President, Corporate Affairs Europe, Genzyme Corporation, Belgium
Hansvolker Ziegler, Deputy Director-General, Ministry of Training and Research (BMBF), Germany

Discussion panel

Attila Havas, Director, Technology Foresight Programme (TEP), Hungary
Namik Kemal Pak, Chairman, TUBITAK, Turkey
Lena Torell, Director, JRC Programmes Directorate, European Commission

Rapporteur

Uno Svedin, Professor, Director of Research, Council for Research

Session 3: Facing the urgency of crises - early warnings and quick responses

Politicians and scientists are increasingly concerned with the concept of crisis situations, as they are forced to make rapid decisions in the face of uncertainty

In increasingly sophisticated inter-related systems cascades of destabilization can occur, generating previously unknown dangers

The concept of a "crisis" situation is of increasing concern to politicians and scientists, according to Professor Alain Pompidou, former Member of the European Parliament, who opened the discussions. To politicians, because, in such situations, they are forced to take very rapid decisions in areas that are often difficult to evaluate. To scientists, because they are increasingly being called on to provide, within equally short deadlines, knowledge and opinions to assist in choosing between one or another option. Apart from the concept of urgency, today's crises are presenting a radically new type of challenge.

The complexity chain

The first characteristic of such events is the growing complexity of the social infrastructure as a result of the accumulation of scientific and technological knowledge and its impact on all political and economic decision-making processes. Within such sophisticated systems, one "grain of sand" affecting a weak link in the chain can provoke a cascade of destabilization, generating previously unknown dangers.

For Patrick Lagadec, director of research at the Ecole Polytechnique (France), who specialises in analysing and managing crisis phenomena, "the past two decades have been marked by emergency situations of a type totally unknown hitherto". These include: the Chernobyl catastrophe and the resulting radioactive cloud across Europe; the spreading of AIDS through transfusions of contaminated blood; the "mad cow" crisis; and the cyber-crime epidemic. "These crises, caused by serious malfunctioning of health, environmental and safety systems, are set to multiply as the growing complexity of systems is, by its very nature, generating a new range of unknown dangers", he pointed out.

This sentiment was shared by Philip James, director of the UK Public Health Policy Group, and a key player in the later management of the European BSE crisis. "We need to become fully aware of the incredible inter-dependence of transnational food chains, such as those in animal products", he explained. "With their constant procrastination while managing this crisis, European decision-makers have, until now, been very slow in waking up to the dangers that lie in wait for us and to the many crises that these can potentially engender."

Rigorous information

A second characteristic of contemporary crises is the sheer quantity of information being disseminated via the media and new communications technologies. Decision-makers are placed under immediate and direct pressure by public opinion, which, in certain cases, can give rise to uncontrollable rumours and reach a level of hysteria. The public is looking to hold people to account and no longer possesses blind trust in the way

decision-makers and experts together manage risks and their possible consequences.

This change in the nature and perception of crises represents a social challenge of the first order, calling for a rigorous and demanding approach to ways of anticipating crises, preventing them and, when they do occur, dealing with them.

Such an approach implies a critical and systematic analysis of responses to recent crises to develop a methodology based on good and bad practice from real-life experiences. David Gee, project manager at the EEA (European Environmental Agency), cited cases listed and analysed by the EEA as well as the examples of asbestos poisoning, lead and mercury pollution, and the detection of antibiotic-resistant strains of microbes.

One characteristic of contemporary crises is the sheer quantity of information being disseminated via the media and new communication technologies

A new crisis anticipation and management culture

"In fact what we need today is a whole new culture of anticipating and managing crisis situations," insisted Mr Lagadec. This involves developing specific training tools (case studies, simulations, etc.), which would facilitate more transparent communication between experts and decision-makers, and between the latter and the general public.

In order to be properly prepared, warning networks need to be set up to detect the advancing signs of impending crises. This should go beyond traditional control and surveillance to look out for "weak signals" normally drowned out in the din of information flows

Out of the same concern for being prepared, we need to set up warning networks to detect the advance signs of impending crises – whilst there is still time to avert them and their effects. This "anti-crisis" watch ought to move beyond traditional control and surveillance principles – which are always found to be wanting when the unforeseen occurs – to include other elements, referred to as "weak signals". "These are indicators that are normally drowned out by the din of information flows," according to Sylvie Faucheux, professor at the Centre d'Economie et d'Ethique de l'Environnement et du Développement (France). "Taken on their own, they are apparently insignificant. When correlated, they turn into warning signals."

The European dimension of crises

Peter Wagstaffe, head of unit, Health and Consumer Protection DG at the European Commission, stressed the degree to which the European Union was now a front line player in risk management. The Maastricht and Amsterdam treaties have considerably extended Europe's areas of competence beyond traditional areas such as environment and health. As a result, the question of crisis management is posed against the backdrop of the Union's ever widening field of responsibilities.

David Wilkinson, director of the European Commission's Joint Research Centre's Institute for Systems, Informatics and Safety, emphasized the extent to which the notion of citizen security is taking on a global meaning and now includes the EU's potential responsibilities for defence and for managing regional conflicts that can threaten the continent – as happened with the intervention in Kosovo and the ensuing order-keeping operation. The EU commitment to international mine-clearance operations in former war zones and the fight against cyber-crime illustrate the need for scientific "management" of security, according to Mr Wilkinson.

Summarizing the discussions, Jacques Poncin, a scientific journalist and rapporteur at this workshop, observed that crisis management had, of necessity, become a specific management discipline, placing demands on politicians and scientists alike. Given the global dissemination of new technologies, such management is meaningful only if carried out at the European, if not global level. This rethinking of crisis management also embraces the media – essential players for both signalling and resolving crises.

Participants in the discussion

Chair

Alain Pompidou, Member of the Conseil Economique et Social, Professor, France

Speakers

W. Philip T. James, Director, Public Health Policy Group, United Kingdom

Patrick Lagadec, Director of Research, Ecole Polytechnique, France

David Wilkinson, Director, JRC Institute for Systems, Informatics and Safety, European Commission

Discussion panel

David Gee, Project Manager, European Environment Agency

Sylvie Faucheux, Professor, Centre d'Economie et d'Ethique pour l'Environnement et le Développement, University of Versailles-Saint-Quentin-en-Yvelines, France

Peter Wagstaffe, Head of Unit, DG Health and Consumer Protection, European Commission

Rapporteur

Jacques Poncin, Scientific Journalist, Le Soir, Belgium

The notion of citizen security is taking on a global meaning and now includes the EU's potential responsibilities for defence and for managing regional conflicts that can threaten the continent

Session 4: Towards a European scientific and technical reference system in a global context

It is essential that all scientific authorities controlling the application of Community rules work from common procedures

An enormous amount of scientific expertise is needed in order to understand the state of the environment, to develop new regulations, to control implementation, to pursue infringements, to handle crisis situations, and to provide information to politicians, industry and the public

Opening the discussion, Herbert Allgeier, then director-general of the Joint Research Centre (JRC), emphasized the significance of setting up a common scientific and technical reference system in the context of the European Research Area. Decision-making within the EU – whether in citizen security, environmental regulation or international trade policy – is governed increasingly by Community directives, whilst remaining largely the responsibility of national authorities. Against such a background, it is essential that all scientific authorities controlling the application of these rules work from common procedures. Equally important is that such a system be managed within a subsidiarity approach. Mr Allgeier also mentioned the JRC's current role in this field. "The JRC's vocation is to develop, with complete impartiality, the harmonized knowledge needed for implementing European policies."

During this workshop, two presentations – one from the viewpoint of a national scientific centre, the other from the Commission's Environment DG – illustrated the importance of strengthening the scientific and technical reference system at Union level. César Nombela Cano, former president of the Spanish Higher Scientific Research Council (CSIC), highlighted areas in which science is making a major contribution in Spain – including combating desertification, cleaning up severe river pollution in Andalusia, and seismic monitoring in the Canaries. He emphasized the long-standing fruitful relationship between CSIC, the JRC and the network of European laboratories cooperating with it. For him, there is a growing need in the European Research Area to develop an advanced common reference system, based on networking between the best centres of excellence, to meet the Union's growing requirements for scientific support for governance.

The environment – an urgent need for scientific reference points

In turn, Prudencio Perera, a director at the Commission's Environment DG, drew up a list of priorities to meet the demands of EU environmental policy. "This policy is increasingly calling for an enormous amount of scientific expertise in order to keep track of the state of the environment, to develop new regulations, to control implementation, to pursue infringements, to handle crisis situations, and to provide information to politicians at Community, national and regional levels, as well as to all the private players concerned and the public at large".

Currently, this expertise is often dispersed amongst Member States, is not always easily accessible when needed, and is difficult to integrate in the absence of coherent and transparent methodologies. Although the JRC is already a major partner of the Environment DG, the creation of an even more developed common reference system would appear to be a real imperative.

The example of Canada

The workshop did not limit its discussions to Europe. Participants followed with keen interest an account of the approach taken by the Canadian Council of Science and Technical Advisers (CSTA), as presented by its deputy chairman, Kevin Keough.

"The CSTA, which was set up almost three years ago, is an advisory think-tank that works closely with the federal cabinet to help it improve its scientific governance, in terms of both principles and directions (see Box 1), and of putting these into practice in various areas such as blood transfusion safety, management of fish stocks, air and water quality, and public policy towards GMOs (genetically modified organisms).

This body is made up of 22 members from the scientific community, the business world and non-governmental organizations. Its aim is to set the priorities for a relationship between science and governance that is based on healthy foundations, which are essential for establishing a climate of trust within society.

A genuine expectation

The very lively discussions which followed the presentations in this workshop showed that "the scientific community expects a great deal from a European reference system", in the words of rapporteur Sergio Barabaschi from the Italian Council of Applied Science and Engineering. But it is also making huge demands – in terms of independence, impartiality, quality, flexibility, inclusion of the best European expert advice, and efficiency – on the way this system is being implemented.

For his part, Mr Allgeier concluded by reminding his listeners that the principle of this major project had already been partially approved by the Council and that the JRC was willing to play a role where appropriate.

Box 1. The six commandments of the CSTA (Canada)

In a report published in 1999 and christened SAGE (Science Advice for Government Effectiveness), the CSTA proposed six commandments of good scientific governance to the Canadian federal government:

- Identify early those fields where it is important to intervene in good time with reliable information allowing decisions to be taken.
- Draw advice from a wide variety of scientific sources in order to capture the full diversity of problems.
- Seek open discussion of scientific problems and experts' opinions.
- Assess, manage and communicate uncertainty and risk.
- Aim for transparent and open decision-making processes.
- Review decisions based on scientific arguments to ensure that they reflect the most recent knowledge.

Participants in the discussion

Chair

Herbert J. Allgeier, Director-General, European Commission

Speakers

Kevin Keough, Vice-Chair, CSTA, Canada
César Nombela Cano, Former President of CSIC, Professor, Universidad Complutense, Spain
Prudencio Perera, Director, DG Environment, European Commission

Discussion panel

Giannino Bernabei, Member of the European Economic and Social Committee, Italy
Marten Carlsson, Professor, Nova University, Sweden
Bruno Hansen, Director, DG Research, European Commission
Tom Pakerton, Senior scientist, Environment Engineer and Toxicology Adviser, Exxon Mobil Petroleum and Chemical bvba, Belgium

Rapporteur

Sergio Barabaschi, Professor, Member of the Council of Applied Science and Engineering, Italy

The Role of Science in Governing Society and in High-Level Decision-Making Processes

Irina Osokina, *deputy minister of Industry, Science & Technology of the Russian Federation*

According to the traditional view, the role of science in a society is limited to the spheres of national security, health and national economic development through carrying out various different types of research, the practical results of which are mainly implemented by industry. Thus, science is considered to influence society only indirectly through its achievements.

Nowadays, however, science plays a more prominent role in our lives and it has become part and parcel of the decision-making process, especially at the highest levels of government. In my opinion science and technologies nowadays have acquired capabilities which allow them to directly manage and influence social processes and enhance social harmony.

Long ago Plato –one of the greatest philosophers of all times– said that the states would truly flourish only when philosophers become the rulers of the state, or rulers acquire the spirit and power of philosophy, and political greatness and wisdom are brought together. We are perhaps not at that stage today, but this conference is an indication of the importance given to the need to be governed by well-informed leaders who are able to draw upon scientific methods and expertise to support their decision-making.

Russia is today experiencing very complex and difficult conditions of transformation and transition, which demand support from our scientists, and the application of special scientific methods and tools. In other words our progress today and effective management of society are possible only with the active participation of science and scientists from different spheres of knowledge.

To my mind the new mission of science today is that of an active participant and partner in governing society and the state, which helps to define both the goals and the strategies for their optimum achievement.

Speaking about Russia I have to admit that for a long time in my country the role of national science in regulating social and economic problems and in formulating political and economic decisions was minimal. This fact had a negative impact on our everyday life and was one of the reasons for a long period of social and economic crisis in Russia. If we had had scientifically developed and substantiated goals and strategies for the country's development at the end of the 80s and early 90s we would have managed to avoid a lot of mistakes made even taking into consideration all the objective difficulties which accompany any complex reformation.

Science is playing an increasingly prominent role in our lives and it has become part and parcel of the decision-making process, especially at the highest levels of government

Russia is today experiencing very complex and difficult conditions of transformation and transition, which demand support from scientists, and the application of special scientific methods

The Ministry of Industry, Science and Technology of the Russian Federation has taken practical steps to set up a mechanism allowing a constructive and democratic dialogue between science and both the authorities and society at large

One of the Russian Science Ministry's pilot projects has involved developing a model to explore the potential consequences of political, financial and macro-economic decisions

The model showed Russia's regional development problems to be more a result of spending structure than the way tax revenues are shared between central and regional governments

In order to enhance the participation of scientists in the decision-making process and to take into consideration their views and ideas there are plans to expand the standing scientific discussion forum

There is an ancient saying: "even a man limping along the road would outstrip the running one who has lost his way".

"Where is the scientific community in Russia? – You may ask. 'Why it is so inactive?"

The thing is that in order to be heard we need to have at least two main conditions: the willingness of our interlocutor to listen to what we have to say and his ability to hear and understand us correctly. I cannot say that there was no wish on the part of our government to listen to the various different consultants and to attract scientists to different bodies and commissions created by the President or the government during those years. But, unfortunately, many of them turned out to be purely of a representative character, serving mostly to enhance the political image of the leaders rather than practical purposes of the decision-making optimization.

In order to overcome this negative tendency the Ministry of Industry, Science and Technology of the Russian Federation has taken practical steps to set up a mechanism allowing a constructive and democratic dialogue between science and both the authorities and society at large.

It is not possible here to present all our steps and programmes, so I shall give more details of just a few of them. In our Ministry we have prepared, and are now conducting, a pilot project on specialized research and monitoring of the most conspicuous problems of our society's development and are preparing operational recommendations for Russia's highest authorities. We have managed to obtain some very interesting results of considerable practical value.

One of this project's elements is a model designed to make it possible to explore the potential consequences of political, financial and macro-economic decisions.

To give just one example of how this has been used in practice, Russia's budget process involves decision-making on the division of tax proceeds between the (federal) central government and the regions. There has been much debate in our Parliament on the issue of which share of tax proceeds should go to the federal budget. This problem has turned out to be a stumbling block for many of our members of parliament and sometimes it was used as a political lever to force through inappropriate decisions.

Our model, which we developed at the Ministry with the active participation of our scientists, showed us that this long-standing problem was not as decisive for regional development as it seemed to be. Even if we divide the tax proceeds on a fifty-fifty basis between the federal and regional budgets the situation for regional development and the harmonization of living standards throughout the country would not change drastically. The proportion between the donor regions and the recipient regions would stay intact, which means 20 to 80 percent, keeping in mind that the Russian Federation comprises 89 regions. The only difference is that the donor regions would become poorer and the recipient regions would be a little bit less poor.

Our model showed that the major obstacle for the development of the regions is not in the lack of budgeted funds, but the structure of expenditures, which should be changed, and in the lack of adequate financial mechanisms, highlighting the need to set up mechanisms of this kind (for instance, a specialized investment fund for development).

For reasons of space I do not propose to elaborate on these mechanisms here, but would like to underline that our model aroused a lot of interest among our decision-makers and this work was supported by our Government.

In order to enhance the participation of our scientists in the decision-making process and to take into consideration their views and ideas we plan to expand our standing scientific discussion Forum called "Russia in the 21st Century" and by the end of October together with the Russian Academy of Natural Sciences create a specialized web site to start the internet discussion, titled "Science and Society" to enable us to exchange views and ideas on the most urgent and serious problems with the scientific community, not only in Russia but in the world at large, including of course the Internet world (the site is located at: **www.raen.ru**).

Another important problem in a decision-making process as you know is the problem of the information volume and ensuring its validity.

In Russia the period of transition in the political and economic structures of the state has changed radically the requirements for information and the way in which it is collected and processed. Unfortunately in all these years we have not managed to create proper and unified information systems that would allow us to make scientifically supported decisions.

We therefore believe that one of the most important tasks for our scientific community now is to take an active part in developing the complex system of information identification, collection, processing and analysis needed to make proper strategic decisions and to assess their social, economic and political consequences. It is, of course, a very difficult task in technical, technological and methodological terms. However, the role of science in the governance of society should not be limited to supporting the decision-making process. It is very important to enlist scientists in monitoring implementation of the decisions made, in assessing their consequences, and if need be, in correcting the way they are implemented. In other words we should ensure the whole cycle: from the point of decision-making through to the implementation of the decisions made and subsequent feedback.

In Russia these stages of society governance are not yet fully developed. Very often decisions which seem correct at first sight lead to negative results or as our former prime minister Chernomyrdyn once said: "We wanted the best, but you know the rest".

So we think that in order to get what we want we should draw the scientific community and advanced technologies into decision-making and governing processes more actively. It is clear that to make full use of scientific achievements one should create adequate economic and legal conditions to enable proper development of scientific and technological potential. Only then would science be able to attain its proper place in any social system.

We think that in order to attract the scientific community to the process of society's advancement we need to formulate a complex strategy of innovation development in Russia where science would serve as a sort of interface between decision-makers and citizens. This is a strategy we have already started to formulate and any outside input on the subject would be welcome.

Coming to the end of my report, I would like to say that today science can allow us to transform not only the technological level of our civilization but also individual self-consciousness and the behavioural patterns of large masses of people. I think that at the end of the second millennium we are witnessing what we might call "a quiet revolution" the consequences of which are of great significance for the whole of civilization: science has been transformed from a means available to the process of governance of society into an autonomous subject governing society.

In this context the problem of the relationship between science and society acquires new signifi-

One of the most important tasks for the scientific community now is to take an active part in developing the complex system of information identification, collection, processing and analysis needed to make proper strategic decisions and to assess their social, economic and political consequences

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cance and raises the problem of its responsibility to society for the processes that take place in it.

This is why it is so important to create a system that would combine the scientific competence of scientists with effective decision-making by society, and thus create a system under which national and professional values become the personal values of scientists. I think we should try to reach this stage in our development because science is the only form of human activity that is able not only to state the problems of human society's development but find competent ways and means of solving them.

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Science, Technology and Change in Decision-making in China

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The first challenge for governance is how to manage science and technology in a context of rapid development

Introduction

Today, changes in science and technology, especially information technology and biotechnology are increasingly affecting the organization of society and the ways in which norms emerge and governance structures operate. This changing scenario will present unprecedented governance challenges for national and international political systems. This article analyses the nature of these challenges and some of the special issues faced by China and it also introduces the changing nature of decision-making there. China is paying increasing attention to promoting science and technology in decision-making, taking scientific evidence and expertise as a basis for decision-making, and using broader-based decision-making models. This is just a beginning but we believe that the development of science and technology will help China to increase openness and to promote democracy in decision-making.

Science and technology: the challenge for governance

In the 20th century, the role of science and technology in economic growth and social progress took on ever greater importance. Science and technology (S&T) has had a profound impact on industrial performance, health care, national security and environmental protection, and has improved the quality of our lives.

In the early part of the 21st century, science and technology, especially information technology and biotechnology will expand human capabilities so significantly and so profoundly that they stand to alter fundamentally the very notion of what we think of as human. These technologies are increasingly affecting the organization of society and the ways in which norms emerge and governance structures operate. This changing scenario will present unprecedented challenges for the governance of national and international political systems.

The first challenge is how to govern these technologies. The challenges for governance are emerging because of the very nature of the technologies involved. The technologies that drove the industrial revolution were systematic and complex, and putting them into use required collective action, social infrastructure, and technical know-how. The nature of information and biological technologies is different in that their control and use are largely in the hands of the individual. This fact makes the effects of these technologies orders of magnitude greater than those of other technologies that have emerged in the past, and the same is also true of the potential impact of their abuse. At the same time, the level of control that is in the hands of the individual makes social governance much more complex than is the case for technologies that require collective action to build, use or maintain. The key problem is to determine how much governance is necessary for a decentralized, distributed system and how to achieve it.

Whereas technologies in the past have tended to require collective action and infrastructure, today's technologies give greater control to the individual, making social governance a richer, multi-faceted process

The way today's technology is reshaping competition means governments now find it harder to use traditional planning tools effectively to manage industrial policy

The very question of what constitutes a "national industry" is hard to answer in today's global economy

Secondly, as S&T advances, increasing knowledge intensity is becoming a fundamental characteristic of contemporary economic activity. This not only changes forms of competition, but also challenges the pattern of government intervention in the economy. In the past, governments could use planning, preferential tax treatment and tariff barriers to implement industrial policy, and to shelter and nurture the development of emerging industries. Today, they generally need to adopt more alternative, S&T-related policy tools such as technological and environmental standards. For governments in most countries, especially in developing countries, it is very much a learning process.

Finally, the globalization of science, technology and the economy has become a powerful trend. It is forcing governments to confront a fundamental tension in the formulation and implementation of policy. On the one hand, government needs to be accountable to national citizens for the development of science, technology and economy, and on the other, national industries are increasingly reliant on foreign technology, markets and suppliers. Indeed, even the most basic question "what is national industry" has become very difficult to answer in many cases. Moreover globalization appears to be intensifying pressure for harmonization of government policies on intellectual property, regulatory regimes, tax, R&D, and many other areas. These contribute to tensions between the desire for national autonomy and the need to achieve positive economic performance.

Additionally, China is facing a number of specific issues. China is a comparatively closed country. Twenty years ago, China embarked on a process of opening up under Deng Xiaoping but it remains closed to the outside world in the ideological sphere due to the screening of external information. However, it is nowadays difficult to limit what citizens see and hear because of cheap and ubiquitous IT from phones, faxes, and radios to computers, e-mail and the Internet.

Another important factor is that for a long time China has been a society with a rigid hierarchy. This means that information is collected from bottom to top, but orders are given from top to bottom. Its premise was that the bottom level could not keep abreast of comprehensive information. But today, use of information technology means that citizens can grasp large amounts of information in a timely way, and so demand greater involvement in decisions that affect them. Moreover, in this age of widespread information propagation, China's traditional organizational structure is unable to respond quickly and flexibly to emergencies, making some kind of reform look necessary.

Changes in the Chinese government's decision-making

To confront the challenge posed by the development of S&T, the Chinese government seems to have been making some changes in the decision-making process. The Chinese government has tried hard to introduce science into decision-making by using up-to-date S&T and by adopting democratic and scientific methods, in order to adapt the process so that it draws upon collective knowledge and absorbs all useful ideas on a scientific basis and with institutional guarantees. This is intended to raise the quality of decision-making and enable effective governance measures to be implemented.

Paying more attention to S&T development in decision-making content

As a large developing country, China is eager to catch up with the developed world. Therefore, compared with European countries, all circles of Chinese society tend to have a more active and optimistic attitude towards S&T. In 1995, the last government announced a strategy of "prosperity of the nation with science and education". The present government is also giving priority to the development of science, technology and education.

The governmental decision-making emphasizes three aspects, the first of which is science and engineering research, i.e. the production of knowledge. Government has strengthened input for S&T and has emphasized supporting high-tech research and development and strategic basic research. After the successful implementation of the "High-Tech Research and Development Programme" ("863" programme), starting in 2001, the "Second 863" programme is due to be implemented, placing particular emphasis on exploiting and using information technology and biotechnology. The "Strategic Basic Research Programme" which began in 1998 received total funding of 4.5 billion, of which 2 billion was used for major science projects and 2.5 billion for strategic basic research.

The second aspect is to encourage innovation in order to apply and diffuse S&T results as widely as possible. Central and local governments have drawn up a series of policies to promote the utilization of knowledge through mechanisms such as tax incentives, price regulation credit, venture capital and so on.

The third aspect is to develop and manage manpower resources, and in particular to develop education and raise the public's S&T level of IT know-how and use. To address the problems existing in Chinese education, the government has reformed the educational system and has bolstered educational funding. Education spending has been increased to 10 billion over the five-year period from 1998 to 2003, and at the same time all circles of society have been encouraged to invest in education. As part of this drive for education, the Ministry of Education has initiated the "21st Century of National Educational Prosperity Programme".

The Chinese government has realized that S&T is a strong force for promoting social development. It not only means to directly apply S&T results in production and to raise labour productivity by a sizeable margin, but most importantly it aims to take S&T as an unified knowledge system and thinking tool, with which to help observe and analyse complex and changeable economic and social phenomena. This will enable accurate detection and judgement, thus making scientific decision-making possible in a broader range of areas and so promoting the development of society as a whole and the progress of S&T itself.

Using S&T knowledge as a basis for the decision-making process

S&T has today penetrated almost all fields of people's lives. All government decisions, not only those in the fields related to national interest such as national defence, environment, health, etc., but also those relating to the setting-up of major infrastructure projects, should be based on scientific input. In the past, the political leadership made decisions in isolation, but now the voice of the scientific community needs to be listened to when making some important decisions. Areas where S&T experts have been drawn upon include implementing national, local and sectorial development strategies, population and family planning policy, and comprehensive appraisal of major infrastructure projects. One recent example was the halting of construction of giant national theatre as a result of the opinions of a number of scientists and experts. This is something that would not have been possible in the past.

With the decision-making taking S&T knowledge as its base, demand for decision-making consulting has increased. The traditional brain trust system, which is relatively dispersed and depends on individual experts, was already having difficulty meeting the increasingly needs for collective decision-making. Therefore, people have begun to explore collective decision-making mechanism and ways of complementing the knowledge of different decision-making study groups and

The Chinese government is trying to introduce science into its decision-making and draw upon collective knowledge

The Chinese government aims to use S&T not only to raise productivity but as a tool with which to analyse complex and dynamic economic and social phenomena

Areas where S&T experts have been drawn upon include implementing national, local and sectorial development strategies, population and family planning policy, and comprehensive appraisal of major infrastructure projects

The Chinese Academy of Sciences has set itself the goal of "setting up a national S&T think tank" in the near future

consultants to take the place of individual decision-making in providing high quality advice. The special function of the think tank in the decision-making process has also been considered.

The Chinese Academy of Sciences (CAS), as the highest academic body for national natural science (since the State Council noted in 1984 that the divisions of the Chinese Academy of Sciences were "the highest advisory organ for the nation in S&T") has transformed its advisory role. It has recently set up a new advisory and appraisal committee, known as "The Temporary Provision of the Work for Advice and Appraisal of Divisions in the CAS", and has offered many suggestions regarding national macro-development strategy which have had far-reaching effects. The Chinese Academy of Sciences has set itself the goal of "setting up a national S&T think tank" in the near future. The CAS hopes to draw upon the experience of other countries for reference in this process and its aim is to systematically integrate the whole of the academy's resources and to bring scientists fully into play (particularly the CAS academic group given its important role in advising on major S&T issues for the national economy and defence) in order to provide S&T support for decision-makers and to contribute to the public's understanding of science.

Diversifying decision-making patterns

To supplement existing public opinion gathering mechanisms, public discussion by experts and advisory mechanisms, one of the measures the Chinese government has taken to broaden the scope of public involvement in decision-making has been to hold what it calls "meetings for listening to public opinion". For example, the government of the Beijing Municipality has held two meetings of this kind on the management of telecommunication services and on taxi prices. Although these meetings were attended by representatives of various different interest groups, most of those present were ordinary members of the public. The participants have to consider the evidence on a particular problem, take part in public debates, and produce a consensus report of their findings and policy recommendations. The purpose of this process is not decision-making as such, but rather helping the chief organs of government understand where the public might stand on an issue before considering particular decisions.

Another area where improvements have been sought is through making full use of the role of the media. This involves using traditional media such as newspapers, magazines and television, which have the advantage that they reach large audiences, but the drawback is that there is little or no interaction or feedback. Such media are therefore best suited to promoting general awareness. Additionally, the Internet is also being used. For example, most legislative and governmental departments at all levels have set up some kind of citizen's hotline or suggestions box so they can submit criticisms and suggestions to the relevant bodies. At the same time, some ministries and local government bodies issue information about the decision-making process on the Internet, thus enabling them to seek the opinion of citizens. The value of the Internet is that people can express ideas relatively freely, and can interact with each other in a timely way, but its main drawback is that the skills people need to use it limit it mainly to S&T professionals and young people with high levels of educational attainment. Such people tend to have a relatively high level of awareness and willingness to participate, but form a relatively small part of the population in China and cannot be taken necessarily to reflect overall public opinion.

Conclusion

Today's governance structure is facing the challenges brought about by the development of S&T. At the heart of the changes taking place are the

transformation of centralized and hierarchical management structures into more distributed horizontal patterns, and for the decision-making process to become more scientific and democratic. Some changes have already taken place in China in this respect, but to really make decision-making scientific and democratic, not only do the problems for promoting S&T development and the application of advanced technology need to be addressed, but institutional guarantees are also needed. Therefore, this remains a long-term task in China. But we believe that S&T development and the adoption of new technology will promote the further openness and democracy in decision-making.

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Involving the Public in Social Decisions: The Case of Science and the Role of Ethics Committees

Octavi Quintana Trias, *Vice-President, European Group of Ethics in Science and New Technologies, Spain*

Decision-makers tend to seek to involve the public only when difficult or unpalatable decisions are at stake; it can be argued that there are limits to the extent to which the public can and should be forced to make these judgements

Citizens have shown an interest in participating in some public decisions, and their input can help decision-makers understand the public's values and preferences better

Public mistrust of politicians, industry, scientists and the media rests on a view that each group has its own particular agenda which prevails over reliable and transparent information

Involving the public in social decisions is the one of the main themes of this conference. But, before proceeding further let me recap the argument some people have put forward regarding the degree to which the public should be involved in the difficult choices society has to make. It is easy to take preferences on board when choices are not controversial, but very often decisions are controversial and even unpalatable. There is, therefore, a serious question as to whether the public could or should be forced to make unpalatable judgements.

Decision-makers are faced with painful choices. Not surprisingly they are looking for someone to share the burden. Furthermore, forcing people to make such decisions allows authorities to elude their responsibilities. It can be argued that authorities have been created to make informed judgements on behalf of the public. If decisions were not unpleasant and unpalatable it seems unlikely that the public would be invited to contribute. To complicate the issue it is not clear that the public is willing to participate when difficult choices are at stake. Studies conducted in the US, the UK and Canada show that when the average citizen is confronted with decisions such as priority setting in health care, he has little interest in contributing and rarely has the requisite skills for the tasks asked of him.

In recent years we have seen an increasing interest among citizens in participating in some public decisions and particular interest in ensuring that the choices made take into account their preferences. Involving the public in difficult choices provides decision-makers with a better sense of the social values at stake and gives the decisions made more legitimacy.

Choices in society are the expression of conflicts of values. It is clear that in order to make choices socially acceptable decision-makers need to know what the public's values and preferences are.

Values are built through a complex interaction of tradition, beliefs and up-to-date information. Tradition cannot be changed and beliefs change only slowly. Thus the information provided is crucial for building values. When choices have to do with scientific developments public opinion is closely related to social values and to the information the public receives. However this information is not easy to convey for many reasons. On the one hand communication between scientists and the public is frequently difficult. Scientists often fail to understand the fears and expectations of the public when a new technology appears and the public often has difficulty grasping the scientific challenges at stake. One clear example is the application of biotechnology in the agrofood business. Scientists underline

that the risks inherent in this technique are no greater than with traditional agriculture and food production. On the other side the public do not perceive any advantage to using these products except that they boost profit for some companies.

To make the issue harder there is an increasing mistrust of the public towards the main stakeholders: politicians, industry, governments, media and even scientists. The general belief is that each of them has its own particular agenda and that this agenda prevails over reliable and transparent information. That is why NGOs have more credibility with the public since they are viewed as not having vested interests and that their goal is to provide the best information. NGOs are not supposed to gain financial profit or political power when providing information to the public. An important social challenge this conference has been addressing is how to close the gap between scientists and society. The law has no real power to improve trust and communication. The only thing it can do is to prevent abuses that are unlawful but this is not enough.

Some stakeholders have declared adherence to important social values to be a way to close the gap. They have established professional codes of ethics as a signal to the public that even if they have interests they undertake not to break certain rules that express universally accepted social values. Such adherence to social values aims at increasing public trust in the main players.

Ethics committees have a major role to play in this complex scenario. In particular, they can act as bridges between science and society. Their members must be independent, and be perceived to be free from any conflicts of interest.

Ethics committees need to be multidisciplinary to avoid bias in their opinions. They need to follow a series of steps including.

- Addressing an issue because there is a problem, that is, a conflict of values. Otherwise they would not be needed.

- Asking for experts' advice on the technical aspects of the technology at stake. They need to be familiar with recent developments including risks and benefits as well as its possible future developments. The permanent platform proposed in this forum may be a very valuable tool for that purpose. One of the main problems we face when dealing with new technologies is that people talk about different things or they do not understand the real issues at stake. The debate on stem cells is a clear example of this, as the issue is complex and developing very quickly. Furthermore the terms used ("therapeutic cloning") are inappropriate and they add more confusion to the debate.

- Listening to the public once the technical issues of the problem are understood. Although the media shape public opinion it is a simplification to rely on the media because they address a variety of very different audiences. A public hearing with all the interested parties is a suitable approach for gathering opinions from those with an opinion on the issue. The usual participants are industry, scientists, patient associations, consumers, religious organizations, NGOs, governments and MPs. It is clear that many people do not have a strict interest but they also have an opinion which cannot be captured through a public hearing. If this opinion is to be gathered, specific surveys may be conducted but they consume a lot of time, effort and resources.

- The members of the ethical committee deliberate. Often it appears that some points of view are not clear enough. Experts are called on again to answer the questions members may still have. In the ensuing debate on the different

Ethics committees can play an important role in bridging the gap between science and society

The members of ethics committees must be independent, and be perceived to be free from any conflicts of interest

Ethics committees need to follow set procedures involving expert input, public hearings and public announcement of their findings

values it often emerges that most people's values are similar. The main difference is the weight accorded to each of them and the way the conflict is resolved. It has to be kept in mind that new technologies produce important changes in the values people hold because they change many social habits and procedures. However, time is needed for these changes to take place and it is certainly not realistic to expect everybody to be able to cope with the rapid pace of scientific developments. That is why moratoria giving people the time they need may be a temporarily acceptable solution.

- In the European context conflicts are often presented as an expression of the sensitivities of each country as if the main differences were between countries. This is useful for the politicians who present themselves as defending national values against the positions of other countries. The reality, however, is that in Europe differences in values are much bigger between groups inside each country than between countries themselves.

- When the time comes for the committee to issue its findings, to ensure independence and transparency it is important that public opinion has access at the same time as the official bodies and institutions. Otherwise the suspicion could arise that the committee's findings have been manipulated to ensure they are favourable. A good way to release the committee's report is therefore at a press conference.

Conclusion

Involving the public in social choices concerning scientific developments is important because it is the best way to capture their values and thus take decisions that are socially acceptable. It also gives legitimacy to the process and the results obtained. To incorporate public values is not easy, however, given that the public is not homogeneous and the result will depend on what you ask and whom you ask. A significant obstacle to communication with the public is its mistrust of many stakeholders.

Ethics committees have been shown to be an excellent bridge between science and society and a way of promoting the often difficult dialogue. They are flexible and earn the trust of the public because they are independent and ostensibly disinterested, moreover their opinion is given in the form of a recommendation rather than an executive order, distancing them from the direct wielding of power. They need the support of the scientists to address the issues. I think that one of the main results of this Conference will be to encourage the creation of the scientific platform to provide the best and most up-to-date information to the process of dealing with new scientific developments.

Involving the public in social choices concerning scientific developments is important because it is the best way to capture their values and thus take decisions that are socially acceptable. It also gives legitimacy to the process and the results obtained

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Conference Conclusions: Towards a New Alliance between Science, Citizens and Society

The pervasive impact of science and technology in all policy areas has made debate on this subject both timely and necessary so experience can be shared between countries and a better understanding of the paradigm shift that is taking place obtained.

1. The conference on science and governance highlighted **the importance and timeliness of the debate on Science and Governance,** especially in light of the **increasingly pervasive impact of science and technology in all policy areas**. Ways of involving of all stakeholders – decision-makers, scientists, citizens, industry and media – in a structured dialogue underpinned much of the discussion.

2. Countries around the world are confronted with **the same problems and can learn from each other**. Some countries are notably more advanced in terms of their thinking on the issues and in terms of the systems they have put in place to ensure the widest possible participation. The United Kingdom and Canada, for example, have developed guidelines for the use of scientific advice by government departments. Others (e.g. China, the Russian Federation) are engaged in a series of reforms aimed at bringing the relationship between science and decision-making into line with modern democratic practice.

3. We are entering a new phase marking a "paradigmatic shift" in the way we conceive **risk and uncertainty**. New real and perceived risks are emerging, accompanied by new uncertainties.

Session 1: Science, Citizens and the Decision-Making Process

4. We are now emerging from a long period of dominance by the twin myths of technological determinism and scientific control. **A better understanding of the scientific process and of uncertainty** is replacing the belief that science is purely objective and free of human influence or responsibility. The complex forces shaping scientific innovation include human visions and values, which can and should be rendered more accountable in a wider democratic process.

   Similarly, the belief that all relevant risks have been identified is no longer credible as a determinant of rational policy; there is widespread public experience of unexpected effects and the inability to predict outcomes. Nevertheless this new context of public questioning (not blanket mistrust) should be seen as a positive turn for society and for science. It provides new opportunities, but also new forms of responsibility, which require negotiation. The EU is well-placed to pioneer and to benefit from these new conditions.

5. **Public "mistrust"** of science is highly discriminating. It is not typically "fear", nor does it arise from observed disagreement among experts. In general different categories of scientists-govern-

ment, university, commercial- have different "mistrust ratings". Private ownership of knowledge has increased; even the universities, the traditional repositories of "public knowledge", have positions to defend which may influence the outcome of their studies.

Allowing a wider participation in the scientific process – by stakeholders and by the public alike – should not be considered a replacement of the existing democratic institutions but rather as an enrichment of them.

6. The relationship between science and society must become **more two-way**, involving scientific institutions listening to and learning to understand public concerns and values, and not merely seek to educate the public. Improving **scientific education and public literacy** is of course important, but the public has often been shown to have the capacity to assimilate science when it sees its relevance and usefulness. More education will not reduce public mistrust of science because studies have indicated that the well-educated sections of society often show the greatest mistrust. Citizens' capacity to contribute towards a scientifically informed democracy is often underestimated by scientific policy bodies.

7. Public inputs to policy debates are not merely "opinions", but may be relevant knowledge, values or questions which scientists have neglected. There needs to be a long-term process of mutual learning between the public and science, which will necessarily involve **new institutional relationships and forms**. This will require deliberate experiments in the design of new hybrid institutions and roles. Tools should be explored to bring the public closer to debates on science and technology and its repercussions (e.g. consensus conferences, focus groups, etc.). The general diversification of knowledge sources and actors in modern society should be accepted and used as a platform for further development of democratic knowledge cultures, also including innovation cultures.

Session 2: Anticipating Risks: Foresight and "Precautionary Research"

8. Science and Technology are quickly rapidly. With regard to science the need to deal with more complex relationships, including the interplay of phenomena on different temporal and spatial scales, calls for new alliances between domains of knowledge. The change of systems boundaries and the need to take into account indirect effects, resulting from causal relationships not perceived earlier, drives the need to change the practice of science.

9. **Prospective studies** should be encouraged to help identify/anticipate potential risks, in order to alert policymakers, facilitate the corresponding formulation of policy, and help enhance dialogue with relevant actors.

10. More generally, developing further **precautionary-type research** will benefit from the creation of **appropriate incentive structures** (providing new reward/recognition mechanisms, emphasizing interdisciplinarity, stressing the study of uncertainty, etc.). Funding of science and technology has to reflect these changes in terms of the design of institutions as well as in terms of priority-setting.

11. The need to involve **normative considerations** in dealing with precautionary-oriented scientific issues is also an element that has a transforming capacity. Many of these issues call for various forms of participatory processes within which stakeholder involvement is important both for the formulation of concepts and questions as well as for implementation.

12. The broadening of what is really meant by a technology product, including the shift into providing services, **changes the character of innovation**. Designs need to exploit potential benefits while seeking to avoid potential risk. Ethical considerations should be incorporated in the early phases of the design process. The perception and evaluation of risks and uncertainties should recognize their fundamentally contextual nature.

Session 3: Facing the Urgency of Crises: Early Warnings and Quick Responses

13. A scientific approach needs to be applied to the **management of crises**, not just their substance. The complexity of today's crises means that many organizations and individuals are involved in their resolution, posing problems of harmony and coordination. Modern crisis management needs to move away from traditional hierarchical "command & control" methods towards a more collective approach in which tasks and information are shared openly. This involves a significant change of working culture on the part of those involved.

14. **Crisis prevention** is also an area, which is in need of further research and action. Attention should be given to formulating a **strategic approach**, which would analyse the consequences of crisis events before they happen, and develop organizational and tactical methods for dealing with them. Such an approach would aim at introducing the collective culture of crisis management referred to above through **training and awareness programmes** applied at all levels. These should be based on realistic crisis scenarios and benefit from the experience of recent events, otherwise there is a considerable risk of repeating the mistakes of the past. In this regard, it is essential to avoid an initial state of political denial.

15. A long term monitoring function is needed to detect **early warning signs**, however weak these may be. The kind of monitoring work can vary according its target subject and its objectives, and on whether the activity is focused on meeting social needs, gathering scientific evidence or verifying compliance with regulations. Historical analysis shows that warning signals do occur well before crises have become apparent. In the few cases where these have been detected, the precautionary principle has been implicitly and universally applied. A particular challenge is the early detection of events whose adverse effects take many years to show themselves. Delays in introducing corrective measures can also be aggravated by requiring an over-rigorous scientific analysis.

16. **Institutional arrangements** for early warning detection need to pull together foresight and surveillance in an overall conceptual framework. The assessment process should not be confined to experts; institutional arrangements should ensure a multidisciplinary approach, lay participation, independence and freedom from regulatory capture. Assessment of potential threats should take account of all costs and benefits - direct and indirect, social and economic. Apart from the social costs involved, ignoring negative externalities may wrongly show innovative lower-risk alternatives in bad light. The right balance between risk and innovation has to be struck throughout this work.

17. **Openness and transparency** should be the guiding principle of crisis management, in which the assessment, management and communication of risks are treated as an integral whole. Citizens need to become better acquainted with the concept of risk and of the steps needed for proper crisis management in order to avoid irrational or emotional reactions as far as possible. This would also have the

effect of reinforcing the government's duty to take account of the views of an informed public. Indeed, experts tend to regard their perception of risk to be more valid than that of the public; whereas in fact citizens' concerns are often a rational response to the many uncertainties. These are exacerbated by the single market and globalization, which distribute the supply chain across different countries, complicating enormously any audit trail. The many dimensions of a problem also complicate uncertainties, only some of which may be apparent at the outset. The danger is therefore that remedial measures based on a rapid assessment might miss the target. While public authorities certainly need to be empowered to act quickly, review mechanisms should allow adjustments to be made where the effectiveness or proportionality of initial decisions are called into question. A more coherent and wider approach to crisis management, in which for example both food and environmental aspects are considered together, will be required to ensure that an adequate and holistic response is forthcoming in Europe.

18. There is increasing awareness of the need for a common European or even global response to crises which affect our **security** (e.g. those involving regional and national security, weapons of mass destruction, humanitarian de-mining, etc.). But a wider concept of security would focus on the socio-economic effects and on the individual, not just the nation state. Managing crises which threaten economic and human security (cybercrime is an example of this) requires a similar coherence of approach. Some initial steps are being made in this area, but they will need to be supported by appropriate scientific and technological expertise and infrastructure.

19. A political gesture is needed at the highest level in order to ensure that crisis management is placed on the European policy agenda. This should be followed by the creation of a Task Force whose principal mission would be to raise awareness among European institutions and policymakers. Such a task force would ideally be supported by a **network of experts in crisis management**, to inform policy development in this area and to provide advice on specific crisis situations. This work would include the establishment of a list of centres of excellence, which can identify and carry out relevant research into crisis management.

Session 4: Towards a Scientific and Technical Reference System in a Global Context

20. As underscored in the conference and as outlined by the Commission's Communication "Towards a European Research Area", there is a strong need to **establish a common scientific and technical reference system** for policy support in Europe. It should play the role of translator of relevant knowledge to policymakers and stakeholders, communicator of the common denominator of agreement/disagreement across views, and assessor of the risks involved and of the uncertainty related to our dynamically evolving knowledge base.

21. **Networking** with experts and organizations around the world will be pursued by the reference system. At a global level, the system will provide an EU-level interlocutor to enrich the knowledge base, and to address differences in technology-related issues at an early stage, for example before they become thorny international trade disputes.

    To perform effectively, the system should have a set of **guiding principles** established at a European level. However, a key factor in the success of such a system must be **operational flexibility** to enable networks to perform effectively, and to call on the relevant expertise when needed.

22. The system should provide **continuous advice and support, reviewing** science-based decisions in the light of recent advances in knowledge. It should encompass **prospective** activities in order to anticipate the main scientific and technological trends and their policy-relevant impact. It should be **inclusive** of alternative views without compromising its scientific rigour. The system should be "dynamic", and capable of evaluating its own modes of operation and effectiveness over time.

23. The system should be **institutionally anchored at EU-level**, thus having no private or national colours attached to it. Its institutional anchor should include Commission services with respected research credentials, able to interface effectively with the participating centres of excellence.

A wealth of knowledge and expertise already exists within Europe. The system's aim will be to harness this know-how by tapping into relevant existing structures and experience.

European Research Area and Governance - Follow-up of the Conference

24. A **follow-up team** should be set up to ensure these conclusions are translated into practice, their diffusion among policymakers, regular updating on developments, and alerting European institutions when appropriate.

25. In terms of structure, an EU S&T reference system needs to be launched, based on **networks of centres of excellence**, providing a **common knowledge-base for S&T reference**, and facilitating the **dialogue** between stakeholders, scientists and policy-makers. **Benchmarking** will help identify different practices across countries. The first step in this process, the building of the networks, will be enabled by the Commission's European Research Area initiative, and indeed can be a showcase of what this initiative can deliver.

26. The **role of the media is pivotal in the integration of science and governance**. Too often reference information or "fact-checking" by the media has to rely on sources that are not necessarily impartial, nor broadly representative of different viewpoints. **High-level international and European journals** dealing with these issues could be of significant help. The European S&T reference could provide support to public information.

27. European citizens, and scientists themselves, are increasingly concerned about the **ethical implications** arising from the use of new technologies as well as the risks and uncertainties associated with them. Even if European citizens largely share common values and ethical principles, cultural factors often cause different understandings of issues of major significance concerning ethics. The recent debates on therapeutic cloning highlight the urgent need to support a pan-European dialogue on ethics, and even more so in view of the forthcoming **accession of the enlargement countries**, and the integration of their scientific communities into the EU decision-making processes.

28. **The science and governance interaction can contribute a new dimension to the Commission President's initiative on overall Governance** and the corresponding White Paper on the topic.

IPTS publications

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The mission of the Institute is to provide techno-economic analysis support to European decision-makers, by monitoring and analysing Science & Technology related developments, their cross-sectoral impact, their inter-relationship in the socio-economic context and future policy implications and to present this information in a timely and integrated way.

The IPTS is a unique public advisory body, independent from special national or commercial interests, closely associated with the EU policy-making process. In fact, most of the work undertaken by the IPTS is in response to direct requests from (or takes the form of long-term policy support on behalf of) the European Commission Directorate Generals, or European Parliament Committees. The IPTS also does work for Member States' governmental, academic or industrial organizations, though this represents a minor share of its total activities.

Although particular emphasis is placed on key Science and Technology fields, especially those that have a driving role and even the potential to reshape our society, important efforts are devoted to improving the understanding of the complex interactions between technology, economy and society. Indeed, the impact of technology on society and, conversely, the way technological development is driven by societal changes, are highly relevant themes within the European decision-making context.

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- Technologies for Sustainable Development
- Life Sciences / Information and Communication Technologies
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