Introduction

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This book presents the main ideas, discussions and findings of the workshop on *Interfaces between Science and Society* held in Milan in November 2003.[1] Organised by the Knowledge Assessment Methodologies group of the European Commission's DG Joint Research Centre, the workshop was attended by more than 120 people working in this broad area. The chapters in this book have been contributed by the organisers of the breakout sessions of the workshop, who are leading academics in their fields.

Research on the interfaces between science and society is a growing field. This is the direct consequence of how science has evolved to pervade public life and of how society is becoming an active participant in this changing role of science. This has led to the emergence of a new conception of knowledge, based on awareness of complexity, uncertainty and a plurality of legitimate perspectives. As a result, democracy is extending into the previously quite exclusive scientific realm, and science must submit to public scrutiny and participation in the appropriate ways. In other words, the public is beginning to become engaged in the governance of knowledge. Therefore, a reflection on the methods and tools for knowledge quality assurance, namely on its inputs to extended policy and decision-making processes, is needed.

The ultimate objective of this book is to contribute to the overall improvement of the interfaces between science and society. The structure of the book is based on that of the workshop, in which the following six themes were discussed:

- How to communicate among plural perspectives
- Accepting and learning how to manage uncertainty, complexity and value commitments
- Acknowledging new conceptions of knowledge
- Implementing transparency, openness and participation in science policy
- Valuing community-based research

* The views expressed here are those of the authors and may not in any circumstances be regarded as representing an official position of the European Commission.

1 alba.jrc.it/interfaces

- Exploring how new information and communications technology (ICT) can support inclusive governance

These emerging themes provide a framework with which to conceive, discuss and evaluate the changes now occurring. The chapters cover theories, practices, approaches, experiences, ideas and suggestions for us to move beyond 'talking the talk' to 'walking the walk'.

The book's main added value is a fruitful dialogue, as different chapters look at different dimensions of science–society interfaces. Whereas some ask for more, others ask for reflection, but all acknowledge that science and policy interfaces are dynamic processes and that their roles need to be continuously redefined. The purpose of this book is to contribute to the enrichment and deepening of our understanding of these important new trends in the social relations of science, which are fundamental to our understanding of what and where are the prospects for further progress.

Science

The aim of the project of science has been to provide answers for questions about the world and how it works. In his utopia *New Atlantis* of 1624, Francis Bacon wrote:

> The end of our foundation [the house of Solomon] is the knowledge of causes and secret motions of things, and the enlarging of the bounds of human empire, to the effecting of all things possible.

And science and scientists have been attempting this ever since. It has taken a long time for the second part of this programme to be achieved. For that entire period, the concept of 'pure science' ruled. Now that has changed, and the connection of science with production and policy is well recognised. But habits in ways of thinking have persisted from the earlier period. We need to recognise them, correct them and move on. A new ontology is emerging, as science is losing its status as the only means for 'the effecting of all things possible'. In fact, scientists and citizens are now interacting with each other as never before. These new interactions go beyond pure scientific curiosity on one side or attempts to solve problems associated with scientific processes and products, disregarding the context in which they appear.

Science is therefore going through an evolutionary process, perhaps one of its most painful ones. It is not just a new paradigm that is appearing—it is almost as if science itself had become a rigid paradigm in need of a change. Given that science is a complex system, this process has been and will be disturbing for scientists, policy-makers, decision-makers and the public. The establishment of a new paradigm presents both dangers and opportunities, in what are challenging times.

Society

Society is made up of individuals. For there to be a stable democracy, individuals must act as citizens. The qualities and attitudes of citizens are shaping the evolution of our political systems. As Habermas (1992) says: 'the institutions of constitutional freedom are only worth as much as a population makes of them'. The impact of Western lifestyles in both the political, social, economic and environmental systems cannot be underestimated. Illich (1973) referred to *conviviality* as the opposite of technocratic production, the concept that recognises that *'people can do more than relinquishing the task of envisaging the future to a professional elite'*.

In a post-war setting, Marshall (1950) thought that citizenship was mainly a question of ensuring that everyone should be treated as a full and equal member of society. He focused therefore on rights—namely, civil, political and social. Marshall (1950) identified these three types of rights as general description of the evolution of the concept of citizen in the last three centuries: civil rights arising in the 18th century, political rights in the 19th century and social rights in the 20th century. Arguably, the most important achievement of the Western world is the welfare system that provides their citizens with these types of rights.

But, if historically citizenship meant fighting for rights, now it is time it tackled responsibilities. The balance of rights and responsibilities is one of the most fundamental questions when talking about individuals, citizens and societies.

Interfaces between science and society

Science and society face new and unprecedented challenges and can no longer ignore each other. They are now at a crossroads from which they must continue together. And, if science is a complex system and if society is a complex system, their interface will be a doubly complex system (Dryseck 1997). And this is where we stand now—lost in a complexity that cannot be reduced to easily workable systems.

Conditioned by a narrow and dogmatic scientific training, scientists never learned to communicate among plural perspectives. They have generally felt uneasy about accepting and managing uncertainty, complexity and value commitments, and they have reduced knowledge assessment to peer review of narrow technical issues. Now the public is demanding transparency, openness and public participation in science policy. Community-based research and new forms of governance—including the use of ICT—are now emerging as useful and relevant experiences in a changing world. These are new challenges for interfaces between science and society, affecting both scientists and beneficiaries of science.

Plural perspectives

Although it has left open questions about quality of scientific information, postmodernism has left us with a positive heritage by giving us the courage to face plural perspectives. Rather than be afraid of it, we should take advantage of it. Plurality of perspectives is, in our times, an historical necessity and therefore should be seen as a progress in the history and communication of science. We need to learn how to listen to and understand these plural perspectives, and to create the appropriate procedural and institutional means to enable this communication to take place and to make judgements about the quality of information.

Uncertainty, complexity and values

There are a number of epistemological, methodological, practical and institutional questions that arise when society in general and policy-makers in particular have to deal with when environmental issues that involve uncertainty, indeterminacy, ambiguity and even ignorance.

The precautionary principle is a political and normative principle that legitimises and shapes decision-making when this need arises. It is therefore an important step forward in acknowledging and dealing with these issues. Moreover, understanding the complexity of scientific knowledge is crucial for dealing with uncertainty in the science–policy interface. Understanding and acknowledging the role of values in all processes of the creation and management of knowledge is another necessary way forward.

The implications and the experiences of actual incorporation of uncertainty, complexity and value commitments in policy-relevant knowledge present a new paradigm in environmental policy. In this new paradigm, philosophy and ethics are side by side with science.

Knowledge assessment

A new concept of knowledge is emerging, based on this plurality of legitimate perspectives and awareness of complexity, uncertainty and values. This new concept demands a democratisation of knowledge and entails a reflection on the methods and tools of its quality assurance: namely, on its inputs to extended processes of policy and decision-making.

This leads us to reflect on the governance of knowledge. By this we understand:

- The institutional arrangements used for dealing with knowledge when integrating the outcomes of participatory processes
- The policing of new knowledge, and

- New perspectives on the legitimacy of different types and forms of knowledge

The democratisation of knowledge also leads to a reflection on the mechanisms and tools for knowledge communication, and for the mediations between decision-makers, scientists and lay stakeholders.

Transparency, openness and participation

The European Commission's White Paper on governance[2] published in 2000 has five basic principles: openness; participation; accountability; effectiveness; and coherence. This political statement of commitment towards these new needs of the political process is a good start, but there is still a long way to go. The challenge now is to deal with specific problems of transparency, openness and participation in science policy processes.

Civil society is becoming a fundamental actor in this process. Public access to information, which the Aarhus Convention (UNECE 1998) will soon make compulsory, demands this opening of environmental policy—especially in cases where uncertainties, ambiguity and ignorance are involved. The public acknowledgement of uncertainties challenges the normative role of science as a provider of a solid background for good practice and more is needed than facts, which may now even not be facts at all.

Democracy and transparency in the decision-making process represent mainly an ethical component that translates into the right to know, the right to be included in the decision process, and the duty to include. Information and participation are the key issues. Civil society is increasingly present and new concepts of active citizenship are becoming routine. Institutions will have to adapt to this and, in the case of the precautionary principle, in which dealing with uncertainty is the main feature, decisions must be seen to have been taken in an open and transparent manner.

All of this involves being open and allowing for conflicting values if they exist, but not to allow a hidden, hypocritical and false discussion of science as progress, innovation and growth *versus* a negative-loaded environmentalism. Responsibility becomes a key issue on all sides—the institutional/regulatory, the industrial, the scientific and the societal.

Community-based research

Community-based research sustains the importance of community participation and is thus a significant step forward in the research world. But it is not a rose without thorns. As in any other new field, problems arise from several sides. Issues of power, roles, conflicts, interaction, trust and legitimacy are some of the problems that have emerged as the process has developed.

2 ec.europa.eu/comm/governance/index_en.htm, 27 June 2006.

Emerging styles of governance and new ICT

The emerging world of new ICT provides policy processes with powerful tools for improving:

- The interfaces between science and society
- Accessibility to those policy processes on the top of existing mechanisms

Interactive tools are being developed to enhance awareness, information, communication, participation, individual and social learning, and extended governance—thus enhancing interactions among the worlds of science, policy and society.

Conclusion

The identification, acknowledgement and acceptance of complexity and of uncertainty are key concepts for enhancing interfaces between the spheres of science and society and policy.

The world is complex and science started by ignoring this complexity and reducing it into workable compartments, by modelling it, and by presenting simplified visions of the world. For a time it got away with this, but now we are faced with it again in the form of unprecedented problems created by this illusion. The same attitude towards uncertainty has prevailed.

By accepting complexity and different types of uncertainty as inherent to our understanding of science, we are taking the first step in learning how to live with it. This recognition has to be shared across all relevant societal sectors so that the impacts of scientific developments can be articulated in extended processes of governance.

All of this prompts difficult and awkward questions that have to be faced with a strategy of foresight and wisdom that allows tensions to be negotiated, autisms avoided and legitimate contrasting perceptions accepted. We need to learn how to step across disciplinary borders by listening, being aware of vulnerabilities and, above all, with responsibility. Ethics must regain a place in a time where we have to face apparently irreducible conflicts and questions, which do not have one single correct solution but, at most, several plausible right ones.

In fact there are no single or definitive answers. Thus we need to have new visions to work towards, including transdisciplinary ones. This book contributes to clarifying what those visions might be. They include:

- Communicating among plural perspectives
- Managing value commitments
- Acknowledging new conceptions of knowledge
- Implementing transparency, openness and participation in science policy
- Valuing community-based research

- Exploring how new ICT can support inclusive governance

These are the emerging themes of a vision on how to improve the interaction between science and society that are explored in this book. It is not a straightforward process, so this book presents reflections on its various aspects, and aims to evaluate the ideas, theories, experiences and approaches that have appeared so far, with their respective advantages and disadvantages. It will also help all those concerned with science to steer the process of change towards positive conclusions, with enrichment both of science and society.

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