Editorial

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Biographical notes: Armin Grunwald (Dr. rer. nat.) studied physics, mathematics and philosophy at the universities of Münster and Cologne. From 1987 to 1991, he was a Software Engineer and Systems Specialist; from 1991 to 1995, he was a Scientist at the German Aerospace Center in the field of technology assessment; in 1996, he was the Vice Director of the European Academy Bad Neuenahr-Ahrweiler and in 1998, he concluded the Habilitation at Marburg University with a study on culturalistic planning theory. Since October 1999, he has been the Director of the Institute for Technology Assessment and Systems (ITAS) analysis at the Karlsruhe Research Center and was a Professor at the University of Freiburg. Since 2002 he has also been the Director of the Office of Technology Assessment at the German Bundestag (TAB). Since 2003, in addition, he has been the Speaker of the Helmholtz programme 'Sustainable Development and Technology'. His main working areas include theory and methodology of technology assessment, ethics of technology, philosophy of science and approaches to sustainable development.

1 Introduction

The basic ideas of Technology Assessment (TA) have been developed in the 1960s and 1970s building on earlier experiences with systems analysis, planning and forecast on the methodological side and on experiences of advising policy since the 1950s on the practical side. The establishment of the Office of Technology Assessment (OTA) at the US Congress in 1972 is often regarded as the first and most important institutional implementation of TA (Bimber, 1996).

In the following decades, in many European countries parliamentary TA facilities with similar objectives but different institutional forms have been implemented (Vig and Paschen, 2000). Additionally, other forms of TA corresponding to different institutional settings (Decker and Ladikas, 2004) have been realised as research-based advising bodies for administrations and authorities. Independent from those differences of implementation TA may generally be characterised by a combination of empirical research, prospective thinking, knowledge production by means of inter- and transdisciplinarity, dealing with uncertainty, rational assessments in normative questions, giving advice to policymakers and the tension between scientific independence and customer's expectations (Grunwald, 2006).

TA shows – according to its strategic focus on *knowledge for decision making* – a high degree of *context sensitivity*. In other words, societal developments such as transformations of governance regimes have an immediate influence on the ways how to

realise and implement TA as research and policy advice. Different TA approaches have been proposed and practised responding to changes of the societal context, for example, participative TA (Joss and Belucci, 2002), constructive TA (Rip et al., 1995), interactive TA (Grin et al., 1997) and TA relying on systems analysis or being based in innovation and technology research. On the one hand, the differentiation is due to different questions each of them is suited to address, on the other hand it is due to different basic distinctions and assumptions which relate directly to images and models of the technological evolution, the role of the state or the market in modern societies, how shaping of technology should work in democracies, etc. This competitive situation has also led to lively and ongoing debates between the various research directions involved (STS studies, innovation research, sociology of technology, practical ethics, etc.). History of TA may be considered as a series of learning processes reacting to changing societal boundary conditions.

Currently, far-reaching developments at the interface of technology and society are taking place which constitute a tremendous challenge for TA and will have an impact on TA approaches and the ways TA should and could be operated successfully. This situation requires starting a new debate on the conceptualisation and on future perspectives of TA, concerning its research aspects as well as its advisory side. The objective of this debate should be rather ambitious: the *proactive modernisation of TA*.

2   Current challenges

Against the background of ongoing general developments in modern societies and their conceptualisations, by for example notions like the risk society (Beck, 1992), the post-industrial society (Bell, 1976) or the information society (Miles, 1988) we are witnessing several, more specific changes concerning the interface between science and technology on the one hand, and society on the other. Among the changes with – taking seriously the above-mentioned context sensitivity of TA – presumably large impacts on TA are:

- Economic globalisation and the decreasing capability of traditional national political systems to govern the technological change, compared to a growing role of global companies and supranational institutions.

- The upcoming knowledge society with an increasing importance of knowledge and a demand for governance of knowledge (Stehr, 2004) as well as showing new patterns of knowledge production and distribution (Gibbons et al., 1994).

- New, competing forms of policy consulting (commissions, councils) as well as new governance instruments and institutions (Voss et al., 2006).

- The boom of foresight processes informing research agendas and technological development strategies as well as influencing the development strategies of branches and regions (Martin, 1995).

- New emerging technologies with cross-cutting features like nanotechnologies or converging technologies (Schmid et al., 2006).

- The internationally acknowledged imperative of sustainable development which leads to challenges of increased complexity and interconnectivity of decisions to be made (Grunwald and Kopfmüller 2006; Voss et al., 2006).

- The network society (Castells, 1997) and the increasing need of involving stakeholders, people concerned and citizens in broad deliberation processes on future developments.

- Ethical challenges resulting from the biomedical sciences (Fukuyama, 2002; Habermas, 2001).

These developments have already led to some reflections on the future role of TA and on adequate concepts and realisations. New approaches addressing the challenges ahead in a more comprehensive way, however, are still missing.

3 The Special Issue

The Special Issue 'TA – towards a proactive modernisation' provides a forum for an international debate among researchers and practitioners of TA and related fields. It reflects on the current situation of TA from different perspectives, provides orientation concerning ongoing and future societal changes which will have an impact on TA, makes conceptual and methodical suggestions for innovative developments in TA, responding to the present challenges and proposes new ideas of embedding TA in governance structures and innovation systems.

Obviously, not all of the challenges to above-mentioned TA can be tackled comprehensively in this Special Volume. The main topics of this Special Issue are, compared to the list above: dealing with increased complexity of decision making in modern society (Bechmann and Hronszky, 2003), lessons learnt from innovation studies, especially concerning the involvement of users in innovation policies (Smits and den Hertog), assessing the quality of foresight knowledge (Pereira et al.), considering the evaluator's role of researchers in stakeholder dialogues (Reuzel et al.) and analysing the requirements of technological transformation against the background of sustainable development (Larsen and Höjer).

Gotthard Bechmann, Michael Decker, Ulrich Fiedeler and Bettina-Johanna Krings have been considering the concept of TA as a whole. In their paper 'TA in a complex world', they attempt at reconstructing the core of the idea of TA. The authors find that the original TA concept, aiming at developing a scientifically based and research-oriented consultancy, analysing current and potential societal impacts of technological innovations, based on the principles of research, assessment and advice, has still not become outdated. However, in their diagnosis, scientific and technological progress changes the relation of the intended goals of technology and the unintended consequences. Consequently, the authors support a TA concept with a stronger focus on (re-) considering and reflecting on the unintended side effects from a factual, social and temporal point of view.

Ruud Smits and Pim den Hertog have been concentrating their work 'TA and the management of innovation in economy and society' on the role of TA in innovation systems. Their main question is how TA may, based on recent insights from innovation studies, contribute to a more efficient and effective involvement of users in systemic

innovation policies. The authors follow the history of innovation policy and exploit recent insights from innovation studies. Their consideration leads them to the decisive role of users in systemic innovation policies, and to the question for the problems that hinder a more effective and efficient involvement of users. They ask what TA – and its institutionalisations – could contribute to reinforcing the role of users and how TA should develop further in order to realise this contribution.

Ângela Guimarães Pereira, René von Schomberg and Silvio Funtowicz are analysing how to assess the quality of foresight knowledge. In their paper 'Foresight knowledge assessment', they consider the situation that foresight knowledge has been deployed or generated during foresight exercises which now has to be assessed with respect to its 'quality', especially in situations of conflicting or diverging foresight knowledge. The main difficulty is that foresight knowledge consists of various sources such as different scientific disciplines, normative visions on the future, planning and scenarios, and that it has been created by using inputs from different sectors of society, such as industry, academia and civil society. The authors offer a procedural approach including several steps to operationalise the 'fitness for purpose' of the foresight knowledge, in terms of, for example applicability, reliability, transparency and legitimacy.

Rob Reuzel, John Grin and Tjitske Akkerman are considering "The role of the evaluator in an interactive evaluation of cochlear implantation: shaping power, trust, and deliberation". Though the roles of experts and their relations to stakeholders already have been discussed intensively in TA (cp. Bechmann and Hronzsky, 2003) this is still a challenging issue of TA practice. The authors focus on the distribution of power in deliberation situations using pediatric cochlear implantation as a case study. They describe how a researcher, in an interactive evaluation in this field, maintained a balance between constructively using his power to help tackle the policy problem and leaving the ownership of the deliberative process with the stakeholders. The result is that success critically depends on the researcher's skills in building trust and prudence in applying rules of argumentation.

Katarina Larsen and Mattias Höjer are focussing in their paper "Technological innovation and transformation perspectives in environmental futures studies for transport and mobility" on the different roles of technological change in the development of more environmentally sustainable transport in the future. The authors analyse technological innovation and transformation perspectives in environmental future studies, in particular with respect to assumptions made about environmental effects from new technology and drivers for change. As a result, they identify futures studies as a tool for stakeholder discussion to increase knowledge about facilitators and constraints associated with processes of environmental and technological change, and they derive some implications for TA, especially for CTA.

According to the rules of the *International Journal of Foresight and Innovation Policy*, all of these papers have been peer-reviewed. In each case, the reviewers considered very carefully the content and the structure of the papers, made substantial comments and gave valuable recommendations for further improving the papers. I would like to express my deep thanks to all of them for helping in establishing a high-quality Special Issue.

In this way, mosaic stones for building a further developed picture of TA have been assembled in this Special Issue. They are addressing key challenges with which TA is already or will be confronted in the near future. The debate on the proactive modernisation of TA is opened!

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