Technology Assessment in Europe; between Method and Impact – The TAMI Project

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Introduction

Technology Assessment (TA) is usually described as problem oriented research. This is not however a proper portrayal of TA since many research endeavours can be described as problem oriented. When, for instance, a natural scientist designs an experiment in order to verify a theory or an engineer plans the construction of a bridge, this can also be described as problem oriented research. While these examples represent scientific or technical problems, TA has to deal also with social, political or environmental problems, which are embedded outside science and technology but derive from and refer to scientific issues. Moreover, TA does research on the potential consequences of these developments, the use and the disposal of new technical artefacts or on the development, use and output of new technical production systems. TA contributes to the decision but not necessarily to the technical realisation. In the example of planning the construction of a bridge, TA would deal with the basic question "is there a need for a bridge crossing to the river?" and consider this against the alternative options (e.g. ferry). If necessary, TA would delve into technical aspects (e.g. by comparing the pros and cons of a suspension, rotating or draw bridge). The argumentative ground for these decisions refers to consequences (health, social, economic, environmental, etc.) resulting from the different options.

At the dawn of official TA thirty years ago, TA was focusing on concrete predictions of technological consequences. The aim was to gain advance knowledge on technology options in order to make better (i.e. better informed) decisions. The "early warning" aspect was central to TA business in order to steer clear of identified potential hazards or at least to minimize their effects[1]. The Office of Technology Assessment (OTA), specifically established to provide scientific advice to the US Congress, represents the "classical" TA approach that contributes to the political decision making process by providing comprehensive knowledge on the consequences. This is illustrated by the reasoning for the creation of the institute: "it is essential that, to the fullest extent possible, the consequences of technological applications be anticipated, understood, and considered in determination of public policy on existing and emerging problems" (United States Senate 1972). OTA's initial functions are still valid nowadays within the TA scene and include the identification of impacts of technology, assertion of cause-and-effect relationships and identification of alternative programs and options. In this manner, the division of

[1] Harremoes et al. (2002) sampled very impressive case studies from the past hundred years where early warnings have been missing or failed.

labour between TA and decision making is clear, whereby TA "... gives no recommendations concerning what should be done but [...] provides information what could be done" (Gibbons 1991, p 27).

Overall, the beginning of TA as scientific advice can be described as the effort to develop a comprehensive set of "laws of progress" so that the state can direct technical development (Schmid et al. 2003). In the last two decades, European TA developed several methodological concepts that aim, in general, to enhance the initial approach of "classical TA". Grunwald (1999) has attempted to classify the variety of methodologies into:

The system analysis approach; a multi-step method which at the beginning of European TA was taken as the main paradigm for TA (Jochem 1975; Paschen et al. 1978) and aimed "...as most important research area of system analysis at analysing the potentials and consequences of technical developments" (Eberlein 1995, p 11).

TA as strategic framing concept (Paschen et al. 1978; Paschen et al. 1987; Paschen and Petermann 1991) that takes into account scenario techniques in order to accompany the development of new technologies.

The Technology Assessment of the German Association of Engineers (VDI) that developed an octagon of values referring to feasibility of technical systems, economic efficiency of technical decisions, general economic prosperity, safety and survival capabilities of individual users and the whole mankind, health (including mental and physical well-being), environmental quality aspects, and the possibilities of development of individual personalities and the society as whole (VDI 1991).

Participatory TA methods, which enhanced the scientific oriented TA process by incorporating stakeholders and laypersons. With these methods, TA turned from the primary cognitive questioning (related to a kind of optimizing for decisions by development of relevant criteria) to an endeavour which aims at or negotiates for reaching consensus or compromises in conflict situations concerning technology (Baron 1995).

As mentioned above TA is problem oriented research which aims to contribute to solutions of political, social, ecological etc. problems, i.e. problems deriving from outside the realm of science and technology. The results of TA are, in general, concrete recommendations to policy makers and therefore the original questioning as well as the area of potential impact is outside the scientific system. The shortcomings of the "classical" TA approach can be summarised in the fact that the whole TA-process (starting from the "transformation" of the extra-scientific problem into a scientifically manageable research programme until the feedback of the recommendations into the policy making process) needs relevance decisions, evaluations, and the development of criteria, which *is at least partially normative and value loaded* (Decker and Grunwald 2001). Thus, the division between value neutral scientific advice and political decision, which takes into account norms and values, cannot be kept up. As such, in the initial planning phase the optimism and hope to gain knowledge about "laws of progress" could not be fulfilled. The development of participatory TA can be described as the effort for TA to have a greater impact by

handing over decisions based on values to society itself. Therefore practitioners of participatory TA could claim that their results find acceptance in science as well as stakeholders and laypeople[2]. In most participatory TA-approaches this is realized by a methodological combination of scientific and participatory discourses that influence each other in a positive way (Gottschalk and Elstner 1997).

The advance of participatory TA particularly in Denmark, The Netherlands and Switzerland has been impressive but not without its critics (e.g. Grunwald 2001; Gethmann 2001). Firstly, there are doubts whether it is possible to combine the scientific and participatory components of the TA process without weakening the scientific part of it. The main argument here is that an intense, quality controlled, interdisciplinary, scientific collaboration is of crucial importance to develop concrete recommendations to solve the problem under consideration. It is doubtful whether the scientific part of participatory TA approaches can achieve this (Decker and Neumann-Held 2003)[3]. Moreover, the issue of representation has also been raised questioning the capability of the few stakeholders/citizens participating in the discourse to represent all those that have not been part of the discourse (Grunwald 1999; Liakopoulos 2001).

More recently, the communication aspects of TA have been the focus of discussions in the TA community. These, refer to methodological developments that provide TA with the means to directly intervene in the process of opinion forming by providing new processes of societal communication and not by inducing a particular opinion, perspective or political position (van Est et al. 2002). This new debate as well as the older debates about the merits and disadvantages of classical vs. participatory TA, has been the focus of discussions within the project TAMI.

The TAMI project

The project TAMI (Technology Assessment in Europe; between Method and Impact) was created in order to answer the multitude of questions arising from the developments in TA as discussed above. On one hand, the variety of methodologies within the spectrum classical-participatory TA have been tried and have evolved throughout the years changing the face of TA irrevocably and making an overall review of their potential necessary. On the other hand, a lot of questions about core benefits of TA have been left unanswered for too long. Since TA identifies itself as policy advice and is therefore in most cases publicly funded, this already raises the question of whether TA is worth this funding. Is TA improving policy making on technological issues? How can the impact of TA in policy advice be assessed, and, according to what criteria?

TAMI attempted to explore all major issues of TA in Europe by creating a structured dialogue within the TA community as well as between TA experts and policy

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[2] The concrete composition of the group of people participating is a crucial aspect of the respective participatory TA concept. The criteria here are for example "being concerned", "representative for the respective society", "randomized", etc.

[3] Hanekamp (2001) has made an interesting suggestion to distinguish between three different types of participation: Democratic, administrative, and research participation where the "usual" debate concerning the involvement of laypeople would then be part of research participation only.

makers. By involving an impressive array of most major TA institutes in Europe[4], the TAMI group set out to:

- review and evaluate the state-of-the-art methodologies and practices used in current TA;
- review the issue of impact and develop criteria for its evaluation;
- attempt a systematic and strategic view of the relationship between method and impact;
- identify all relevant factors that influence the functions of TA such as the institutional and political context;
- draw conclusions on a common TA "reference system" that includes the dimensions of Method, Impact and Policy.

To reach its objectives, TAMI followed the so called "twin group principle" whereby two groups, the "method group" and the "impact group", started from different perspectives without coupling. In the second half of the project the combination of the findings of the two groups was initiated in a series of "cross-over" discussions. The advantage of this procedure was that the two groups could function as evaluators for each other's results and within the common discussions it was possible to reach a certain level of commonality between the two working groups without losing the benefit of tackling the issues from two perspectives.

The method group

The method group comprised experts from most TAMI partners with particular interest in the functions and parameters of various methodologies used in European TA. The consortium of partners has been heterogeneous enough and the contextual experiences of each institute different enough to focus the discussion on basic questions about TA. The common understanding of what TA is, was the starting point of the discussions. TA has experienced a series of metamorphoses since its conception days with new aims and functions that would seem unrecognisable as TA by the early practitioners. This has led to confusion as to what exactly constitutes a TA activity nowadays and the method group had to find a common definition to start from.

The next major question has been: "how can TA-practitioners optimise their TA-projects in order to reach the impact they strive for?". Usually, a "customer" orders a TA-project on a particular topic as the basis for a concrete political decision but without any "advance commitment" to the projects results. This means that the project has to develop its own "legitimisation power", in the sense of creating

[4] Members of TAMI were: Europäische Akademie GmbH, Germany; Parliamentary Office of Science and Technology, UK; The Forschungzentrum Karlsruhe GmbH, Institute for Technology Assessment and System Analysis, Germany; Center of Technology Assessment in Baden-Württemberg, Germany; Danish Board of Technology, Denmark; Centre for Technology Assessment at the Swiss Science and Technology Council, Switzerland; Centre of Science, Technology and Society Studies at the Institute of Philosophy of the Academy of Sciences, Czech Republic; Warsaw School of Economics, Institute of Modern Civilisation, Poland; Consejo Superior de Investigaciones Cientificas, Spanish Policy Research on Innovation & Technology, Training and Education, Spain; Committee on Industry, External Trade, Research and Energy, European Parliament; Rathenau Institute, The Netherlands; and, Flemish Institute for Science and Technology Assessment, Flemish Parliament, Belgium.

results that are hard to ignore. In practice, one combines several TA-methods in order to realize the TA-project and takes care that the project is done in an optimal way. But, what constitutes an optimal way depends heavily on contextual parameters that the TA practitioner has to take into consideration. The method group has worked to provide answers as to the optimisation of TA projects with regard to improving their internal consistency and their eventual impact.

The impact group

What constitutes the "impact of TA" is an often discussed but scarcely investigated subject. Impact assessment exercises are rare and refer to particular projects with specific contextual variables (e.g. Oppermann 2001; Renn et al. 1999). The EUROPTA report, focusing on participatory methods (EUROPTA 2000) has identified the problem of impact assessment which is essential in proving the "worth" of participatory processes. As the first step towards evaluating impact, the authors describe an inventory of "political roles" of participatory TA, different influencing factors, point out to the decisive importance of project management (Klüver 2000) as well as the choice of the "right" participatory TA-methods (Eijndhoven and Est 2000). The EUROPTA-project can be seen as the first concerted effort to discuss impact assessment and which TAMI has heavily drawn upon its results.

The TAMI impact group comprised experts from different European TA institutes and from various contexts that had to be taken into account. Whether the institute works in direct contact with the parliament and receives concrete requests to work on, or not; whether its aim includes promotion of participation of stakeholder and citizens in the debate, or not; whether it focuses on interdisciplinary scientific assessment, or not; these are TA "trends" that demand different views of what constitutes impact. Questions such as "what is a common understanding of TA impact?", "what are the prerequisites and influencing factors involved?", "what are the universal functions or roles of TA from which impact should be expected", and, "which methodologies and evaluation procedures can best describe the desired impact?" have been the focus of discussions and results of the impact group deliberations.

The TAMI process

The TAMI project was organised on the "twin group" principle (see above) and strove for common authorship of all participants in the main report of the two groups. Agreement by everybody tends to create intense discussions not only on TA methods and their impact but also on the cultural, societal and political context TA is rooted in. Therefore, the work did also go one step further by requesting consensus.

Feedback loops

There have been various "feedback loops" in the process of the TAMI project. The "twin group" arrangement with occasional "cross over" meetings whereby each group had the chance to evaluate the work of the other group and get feedback for their work, was the main internal "feedback loop". Nevertheless, TAMI consists of

TA experts with big dependencies on outside parameters (clients, institutional context, etc.) which made it necessary to create another "feedback loop" based on exchange with external experts related to TA. Therefore, TAMI organised additional meetings and invited European, national and regional policy makers as well as representatives from industry to take part in the discussions and provide feedback on the work of TAMI.

The first external feedback took the form of a Kick-off meeting which aimed at broadening the discussion basis at the beginning of the project. There, external experts representing various policy-making communities as well as industry with intense R&D efforts[5] were asked to provide their opinion in issues such as:

- What are your expectations from TA-institutes?
- If you were to create such institute, what would be the reasons to do that and what types of product would you like it to produce?
- How would you improve the impact of TA? Could you define specific criteria for success?
- Can you give an example of an influential report?
- What are the main problems in S&T policy that TA can contribute to? And how?
- What do policymakers need for their decisions concerning S&T? What do they think about participation of experts, laypersons, citizens and/or stakeholders?
- Is there scope for collaboration between public and industry TA?

The results of the first external feedback were incorporated in the work of TAMI which was evaluated again during a Mid-term meeting. The external experts in this meeting were again representatives of the policymaking community as well as those with relevant communication expertise[6], and the topics for discussion included a range of issues deriving from the discussions within the two groups of TAMI:

The goals of TA. The discussion in the TAMI project about impact of TA brought up a variety of goals TA is striving to achieve as well as roles TA is expected to play. TAMI developed a typology of impact that shows a set of nine types of roles, ranging from "scientific assessment" of chances and risks to initialising "new policies". What is the feedback on the completeness of this typology.

Quality criteria of TA. High quality is a necessary condition for the viability of TA and TAMI created a list of quality criteria that need to be fulfilled. What is the trade-off between quality and speed that appears a necessary prerequisite from the clientele of TA?

From scientific to communication process. The TAMI project identified communication as a central aspect of the TA mission. Communication aspects of TA refer to

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[5] These were: Andrew Freeman (GlaxoSmithKline), Paraskevas Caracostas (DG Research, Foresight Unit, European Commission), Hans Peter Bernhard (Novartis Services AG) and Josef Bugl (former Member of the German Bundestag, Chair of the Advisory Board of the Centre for Technology Assessment Baden-Württemberg).

[6] The following external evaluators participated in the discussion: Eryl McNally (Member of the European Parliament), Cees Midden (Eindhoven University of Technology), Michael Nentwich (Austrian Academy of Sciences), Paul Berckmans (Flanders' Social and Economic Council) and Otto Bode (German Federal Ministry of Education and Research).

both the process and the output of TA. As far as the output of TA is concerned, TA has an urgent need for proper communication strategy that would increase the reception of the output and therefore the overall impact of TA. Concerning the TA process, in some parts of Europe TA changes from supporting decision-making to raising awareness, stimulating public debates and expanding knowledge amongst the general public can be observed. How does the shift of focus affect the overall impact of TA?

Flexibility. TA projects start with a situational appreciation. However, this cannot be taken for granted during the whole project. Communication is necessary for keeping track both with the ongoing scientific/stakeholder debate and the political/social debate. Are TA projects flexible enough to adjust to rapid changes in the social and scientific debate as well as the policy-making process?

The results of this second external "feedback loop" were incorporated into the final outcome of the project which is presented in this volume.

About this volume

The present volume is divided into three main parts, each representing a particular outcome of the TAMI project.

Part I: Main results

This part includes the main results of the project. The struggle for common authorship has been successful and denotes the willingness of the TA community to overcome differences and reach consensus on very important matters for the functions and future of TA.

The Method Group results are presented under the title "The Practice of TA. Science, Interaction, and Communication". This chapter deals with the main issue of a common understanding and definition of TA, review of methodologies, development of guidelines for project design, quality criteria and project implementation.

The second chapter titled "Towards a Framework for Assessing the Impact of Technology Assessment" is the main outcome of the Impact Group deliberations and covers issues such as common understanding and definition of impact, a detailed typology of impacts, description of influencing factors other than method, and communication aspects.

Finally in the chapter "Conclusions, Recommendation & Wider Perspectives", there is a main summary of the results from both groups and recommendations for actions in relation to the evaluation of impact, communication functions of TA and trans-national collaboration.

Part II: Supplementary papers

This part includes papers worked out by sub-groups of the Impact Group on themes that appeared to be of particular importance in the process of TAMI and where further exploration was deemed necessary.

The first paper "Shaping the impact: the Institutional Context of Parliamentary Technology Assessment" by Laura Cruz-Castro and Luis Sanz-Menéndez explores the influence of the institutional context which parliamentary TA is required to work in. The authors describe case studies from various national contexts and develop conceptual categorisations which lead them to conclusions about the impact of TA in the parliaments and appropriate adaptation strategies.

The following paper "Organised Interests in the European Union's Science and Technology Policy; The influence of lobby activities" by Theo Karapiperis and Miltos Ladikas focuses on the issue of lobbying influence in policymaking in relation to the basic roles of TA. The authors analyse a survey of European members of the parliament and follow a series of case studies at the European Parliament that show both the conflicts and the possibilities for synergies between lobbyists and TA experts.

The paper "Industry Technology Assessment: Opportunities and Challenges for Partnership" by Robin Fears and Susanne Stephan deals with the issue of industry TA, its functions and similarities with public TA. A review of the recent debate and a case-study form the health care sector in the UK, provides the authors with arguments to suggest a road forward towards closer collaboration between the two TA traditions.

The final supplementary paper "Culturally-based Framing Factors that Influence Technology Assessment" by Tomasz Szapiro provides an overview of the literature and a paradigm of cultural analysis based on the "matrix of impacts" as developed in TAMI and adapted to the work of technology assessment.

Part III: Appendix

The annex includes a one page description of each institute participating in TAMI. Since the institutional setting has been identified as crucial momentum within the relation of method and impact this annex demonstrates the particular variety of TAMI-institutions.

It also includes a series of examples for the roles of TA described in the typology matrix of the impact group deliberations. The immense experience of TAMI-partners has been activated to find examples of real-life cases for most of the roles identified in the typology. As a service to the reader, these examples incorporate full information on references and contact details.

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