Chapter 14
Technology Assessment and Policy Advice in the Field of Sustainable Development

Armin Grunwald

Abstract Sustainable development as a societal vision meets with correspondingly broad approval across all societal groups and political positions, nationally and internationally. The number of nations which have signed and ratified the documents of Rio 1992 and the corresponding follow-up papers and the numerous local or regional activities are impressive. However, the pathway to a more sustainable society needs high effort. Scientific analysis and policy advice is required for monitoring and assessing developments and trends relevant to sustainability as well as for designing political instruments, measures and strategies for sustainability governance. In particular, strategies have to be developed to deal constructively with the enormous uncertainties involved. Therefore, sustainability has become a major issue in technology assessment giving scientific advice to political bodies. In this Chapter I will briefly describe the main motivations and origins of technology assessment and its relations with sustainable development as well. As an institutional case of policy advice, the Office of Technology Assessment at the German Bundestag will be introduced, followed by the presentation of some of its reports on different issues such as energy, tourism, and access to information.

Keywords Policy advice · Technology assessment · Parliament · Uncertainty

A. Grunwald (✉)
Institute for Technology Assessment and Systems Analysis,
Karlsruhe Institute of Technology, Karlsruhe, Germany
e-mail: armin.grunwald@kit.edu

A. Grunwald
Office of Technology Assessment at the German Bundestag, Berlin, Germany

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Introduction

Sustainability as a societal vision is—at least on the political-programmatic level—not only potentially acceptable, but does, in fact, meet with correspondingly broad approval across all societal groups and political positions, nationally and internationally (Grunwald and Kopfmüller 2012). The number of nations which have signed and ratified the documents of Rio 1992 and the corresponding follow-up papers and the numerous local or regional activities are impressive.

In monitoring and assessing developments and trends relevant to sustainability as well as in designing political instruments, measures and strategies for sustainability governance (Voss et al. 2006), scientific analysis and advice is required to a high degree, in particular for developing adequate strategies to deal constructively with the enormous uncertainties involved (Grunwald 2008). Therefore, sustainability has become a major issue also in technology assessment (TA) giving scientific advice to political bodies (Grunwald 2009).

In this paper I will briefly describe the main motivations and origins of technology assessment (Sect. "Motivations of Technology Assessment") and its relations with sustainable development as well (Sect. "Technology Assessment for Sustainable Development"). As an institutional case of policy advice by TA, the Office of Technology Assessment at the German Bundestag (TAB, Sect. "The Office of Technology Assessment at the German Bundestag") will be introduced, followed by the presentation of some TAB reports on different issues such as energy, tourism, and access to information related with sustainability (Sect. "Sustainability Issues at TAB: Some Examples") and a cross-cutting project on the relation between parliaments and sustainable development (Sect. "Sustainable Development at Parliaments: A New TAB Project").[1]

Motivations of Technology Assessment

In the twentieth century, the importance of science and technology in almost all areas of society (touching on economic growth, health, the army, etc.) has grown dramatically. Concomitant with this increased significance, the consequences of science and technology for society and the environment have become increasingly serious. Decisions concerning the pursual or abandonment of various technological paths, regulations and innovation programs, new development plans, or the phasing-out of lines of technology often have far-reaching consequences for further development. They can influence competition in relation to economies or careers, trigger or change the direction of flows of raw materials and waste, influence power supplies and long-term security, create acceptance problems, fuel technological conflict, challenge value systems and even affect human nature.

[1]This paper provides a summary of several earlier papers of the author and brings together work from the fields of technology assessment, policy advice, and sustainable development.

Since the 1960s also adverse effects of scientific and technical innovations became obvious some of them were of dramatic proportions: accidents in technical facilities (Chernobyl, Bhopal, Fukushima), threats to the natural environment (air and water pollution, ozone holes, climate change), negative health effects as in the asbestos case, social and cultural side effects (e.g., labor market problems caused by productivity gains) and the intentional abuse of technology (the attacks on the World Trade Centre). The experience with such unexpected and serious impacts of technology is central to TA's motivation (Bechmann et al. 2007; Grunwald 2009). Indeed, in many cases, it would have been desirable to have been warned about the disasters in advance, either to prevent them, or to be in a position to undertake compensatory measures. This explains why the methodologically quite problematic term "early warning" with regard to technological impacts (Bechmann 1994) has always had a prominent place in TA discussions from the very beginning (Paschen and Petermann 1992:26).

Early warning is a necessary precondition to make societal and political *precautionary action* possible: how can a society which places its hopes and trust in innovation and progress, and must continue to do so in the future, protect itself from undesirable, possibly disastrous side effects, and how can it preventatively act to cope with possible future adverse effects? Classic problems of this type are, for example, the use and release of new chemicals—the catastrophic history of asbestos use being a good example (Gee and Greenberg 2002)—and dealing with artificial or technically modified organisms (for further examples, cf. Harremoes et al. 2002). In order to be able to cope rationally with these situations of little or no certain knowledge of the effects of the use of technology, prospective precautionary research and corresponding procedures for societal risk management are required, for instance by implementing the precautionary principle (von Schomberg 2005).

Parallel to these developments, broad segments of Western society were deeply unsettled by the "Limits of Growth" (Club of Rome) in the 1970s which, for the first time, addressed the grave environmental problems perceived as a side effect of technology and technicisation. The optimistic pro-progress assumption that whatever was scientifically and technically new would definitely benefit the individual and society was questioned. As of the 1960s deepened insight into technological ambivalence led to a crisis of orientation in the way society dealt with science and technology. Without this (persistent!) crisis TA would presumably never have developed.

Technology assessment (TA) has been developed since the 1960s as an approach first to explore possible unintended and negative side effects of technology, to elaborate strategies for dealing with them and to provide policy advice (early warning, see Sect. "Technology Assessment for Sustainable Development"). From the 1980s on the idea of *shaping technology* by early reflection on possible later impacts and consequences of technology was postulated (Bijker and Law 1994). The adaptation of this social constructivist programme to TA was done within the approach of Constructive Technology Assessment (CTA, cp. Rip et al. 1995). Parallel to this development in the field of TA, the Leitbild of sustainable

development became a major issue in public debate and scientific research. Against this background, it is not surprising that TA took up the challenge to start thinking about shaping technology in accordance with sustainability principles (Weaver et al. 2000). Terms such as "transition management" (Kemp et al. 1998) and "reflexive governance" (Voss et al. 2006) were coined in order to demarcate the need for and approaches to embed sustainability assessments into the consideration of the governance of transformation processes toward sustainable development.

New and additional motivations entered the field of TA over the past decades, leading more and more to a shift toward "shaping technology" according to social values (and therefore, building a bridge to the idea of design for value):

- issues of democracy and technocracy, or of democratizing technology (von Schomberg 1999): from the 1960s on there are concerns that the scientific and technological advance could threaten the functioning of democracy because only few experts were capable of really understanding the complex technologies. One of the many origins of TA is to counteract and to enable and empower society to take active roles in democratic deliberation.
- the experience of technology conflicts and of legitimacy deficits and little acceptance of some decisions on technology motivated TA to think about a more socially compatible technology. The very idea was to design technology according to social values.
- in the past decade the innovation problems of Western societies influenced also motivations and driving forces of TA. TA was considered part of regional and national innovation systems (Smits and den Hertog 2007) and expected to contribute to "responsible innovation" (Siune et al. 2009) by taking into account ethical aspects.
- techno-visionary sciences such as nanotechnology, converging technologies and synthetic biology entered the arena. Visions and metaphors mark the expected revolutionary advance of science in general and became an important factor in societal debates (Grunwald 2007).

Compared to the initial phase of TA a considerable increase of its diversity and complexity can be observed. In modern TA, it is often not only a question of the consequences of individual technologies, products, or plants, but frequently of complex conflict situations between enabling technologies, innovation potentials, fears and concerns, patterns of production and consumption, lifestyle and culture, and political and strategic decisions.

Technology Assessment for Sustainable Development

Several experiences have already been made in applying ideas of TA to shaping technology for sustainable development. There many different opportunities, contexts, situations, stage of development of the respective technologies but also different challenges, obstacles and difficulties. Main areas have been the fields of

sustainable energy supply technologies, waste disposal, environmental technologies, mobility and transport, and also the exploration of sustainability potentials of new technologies such as nanotechnology and synthetic biology. Recently, an integrative framework for sustainability assessments of technology was proposed (Grunwald 2012).

Technology and Sustainability: An Ambivalent Relation

Generally, a deep-ranging *ambivalence* of the roles of technology in regard to sustainable development can be observed. The relation between technology and sustainable development is usually discussed under contrary aspects: On the one hand, technology is regarded as a *problem* for sustainability and as cause of numerous problems of sustainability, but, on the other hand, it is also and directly considered as a *solution* or at least one aspect of the solution of sustainability problems. This ambiguity is the reason for classifying the relation between technology and sustainability as *ambivalent* (Fleischer and Grunwald 2002).

On the one hand, the use of technologies in modern society has numerous impacts and consequences which conflict with sustainability requirements. This applies for ecological impacts, especially problems with emissions which are harmful for the environment or health and the rapid exploitation of renewable and non-renewable resources. Also in view of social aspects, the technological progress causes sustainability problems, such as the consequence of the technical rationalization for the labor market. At the same time, the *distribution* of both the possibilities and risks of modern technology often objects the claim for justice of sustainability—for example: industrialized countries are often the beneficiaries of technological innovations, while developing countries are primarily affected by the disadvantages. The "digital divide", describing not only the unequal opportunities to use the Internet in industrialized compared to developing countries but also within industrialized countries is an often quoted example (Grunwald et al. 2006).

On the other hand, there are also many impacts and consequences of technological progress which are *positive* in the sense of sustainability. Well-known examples are the prosperity which has been achieved in many parts of the world and the consequential security of livelihood and quality of life, the successful control of many diseases which were disastrous in former times, food security in many (not all!) parts of the world, and the possibility of global information and communication through the Internet. *Innovative* technologies play a key role in the so-called efficiency strategies of sustainable development (cf. e.g., von Weizsäcker et al. 1995). To some extent, modern technologies can already replace conventional technologies and thus contribute to more sustainability (e.g., by fewer emissions and reduced consumption of resources).

This ambivalent relation between technology and sustainability is the starting point for approaches for shaping technology and its societal ways of use (Weaver et al. 2000). These approaches shall be used to realize the positive sustainability

effects of innovative technology and minimize or avoid the negative ones in order to contribute through technological progress to a sustainable development in an optimal way. The resulting question is not whether technological progress has positive or negatives effects on sustainability, but how scientific-technological progress and the use of its results has to be designed to achieve positive contributions to a sustainable development. The questions which have to be analyzed in this context include (following Grunwald 2012):

- How and to which extent can research, development, and use of new technologies contribute to sustainability? How do technology's contributions to sustainability influence other contributions (e.g., of changing lifestyles and a "sustainable consumption")? Within which period of time can the impacts relevant for sustainability be expected?
- Which societal framework conditions can serve as incentive for the development, production, and market integration of innovative technology as a contribution to more sustainability? Which political instruments can support this?
- Which methods can be used to assess whether and to which extent the use of technology can result in more or less sustainability? Which sustainability criteria can be the basis for these assessments and how are they justified? Where are methodological new or further developments necessary, e.g., in life cycle analysis?
- Which standards of comparison, weighing principles, and criteria for consideration can be used in situations of contrary effects and conflicts of aims concerning sustainability?
- How reliable or arguable are sustainability assessments of technology? How should be dealt with the unavoidable uncertainty and ambivalence concerning the knowledge on impacts and assessment problems?

The structure of these questions is very similar to that of the types of tasks of technology assessment (TA) (Grunwald 2009). In the end it is about *prospectively* understanding and assessing technology impacts relevant for sustainability—preferably already during the *development* of a technology. The principle of considering such knowledge on presumable or probable technology impacts already in the early stages of decision-making and making it thus usable for the design of technology itself or its societal "embedment" is part of the basic concept of TA. Therefore, the experience of TA can be used to answer the above-mentioned questions of a prospective sustainability assessment of technology (Fleischer and Grunwald 2002).

Transformation of Infrastructures

The transformation of large infrastructures (such as energy supply, water supply, information and communication, and transport) toward more sustainable structures has to be a *system transformation* where singular technologies are only parts of the

game but where social issues, acceptance, user behavior, governance, power and control are main elements.

For example, the transformation of the energy infrastructure in conjunction with principles of sustainable development is a considerable challenge. Industrialized countries such as Germany have achieved high standards of energy supply. Energy in the form of electricity, gas, or fuel is reliable and has been more or less available to industrial and private consumers without restriction for decades. Changes in these framework conditions can easily lead to societal controversies. Therefore, transformation processes must always take into account the willingness of customers and users to support these changes and implement behavioral adaptations where required. Sustainability assessments of technology therefore must include the 'social side' of the technologies. The energy supply infrastructure is a *socio-technical system*. It can only fulfill its function if supply and demand are balanced, and if the required changes can be integrated into the existing routines of functioning societal processes, or if new routines can be easily established. Therefore, not only is technical competence necessary for the analysis and design of future (sustainable) energy infrastructures, but so are insights into organizational and societal circumstances such as political-legal framework conditions, economic boundary conditions, individual and social behavior patterns, ethical assessment criteria, and acceptance patterns. In addition, other infrastructures must be co-considered with the energy system: in particular the transport infrastructure (through the development toward e-mobility) and the information infrastructures. The interplay between technical potential, complex social usage patterns, and connected regulation and control processes requires a holistic investigation and an interdisciplinary assessment of the transformation-and-governance strategies aiming at sustainable development. Sustainability assessment of new energy infrastructure elements, therefore, must not be restricted to exploring the supply side and to the provision of technical artifacts (machines, power stations, pipelines etc.). Instead, sustainability assessments must consider also *the societal demand and user side*. Research must bridge disciplinary boundaries between the natural, technical, and social sciences and link technical developments to context conditions of markets, organizational strategies and individual behavior. Multiple interfaces between technical, environmental and social issues have to be taken into account to arrive at a comprehensive and transformational knowledge (www.energy-trans.de).

New and Emerging Science and Technology (NEST)

New and emerging science and technologies (NEST) such as nanotechnology, micro-systems technologies, converging technologies and synthetic biology are *enabling technologies*: they can lead to a lot of applications, even revolutionary developments in many different areas. Therefore, they often show high potentials for supporting strategies of sustainable development—however, most of them are

related also with high uncertainties and possible risks. Therefore, there is much more open space for shaping technology compared to the field of infrastructures because of the early stage of development. The main (research) questions for a sustainability assessment of nanotechnologies are, for example (Fleischer and Grunwald 2008): Can nanotechnology development and the application of the resulting products, processes and systems be organized in a sustainable—or, at least, *more* sustainable—manner? How can nanotechnologies and their application paths be shaped in a way that they positively contribute to sustainable development? Are there possibilities of shaping nanotechnologies already in early stages of R&D?

The application of nanotechnology in products and systems is expected to produce a significant relaxation of the burden on the environment: a saving of material resources, a reduction in the mass of by-products that are a burden on the environment, improved efficiency in transforming energy, a reduction in energy consumption, and the removal of pollutants from the environment (Fleischer and Grunwald 2008). A number of studies on precisely the issue of the sustainability of nanotechnology have been published in the meantime (e.g., JCP 2008). However, these developments might have a price. The consequences of the use and release of nanomaterials into the environment are unknown. Although it is not very probable that synthetic nanoparticles in the environment will have long-term effects because of anticipated agglomeration processes, there is no proof available. We do not know about possible long-term effects comparable to the HCFC problem that created the hole in the ozone layer. This situation of high uncertainty and ignorance places a burden of possible risk on future generations while we are exploiting the benefits of nanotechnology today.

Anticipatory assessments of nanotechnology have to cover the entire *life cycle* of the respective technological products or systems. They should include a *temporal integration* and *balancing* of all sustainability effects which might occur during the complete life cycle. For such analyses to contribute to shaping nanotechnologies for more sustainability, they must provide reliable *prospective* life cycle information, such as on health and environmental implications, consumption and production patterns, future developments of lifestyles and markets, and the political and economic framework conditions for the later usage of new technologies. These are only some examples of aspects of the future that need to be known *in advance* in order for reliable life cycle analyses to provide sustainability assessments. A start has already been made toward addressing this challenge for the creation of prospective life cycle assessment. The increasing focus on life cycle assessment as a tool for example in strategy and planning processes, including for long-term issues, and in scenario processes has triggered methodological developments that try combine traditional technology foresight methods with life cycle assessment methods (Schepelmann et al. 2009). Decisive for a comprehensive assessment of nanotechnology or of the corresponding products from a sustainability point of view is that the entire course of the products lifetime is taken into consideration. This extends from the primary storage sites to transportation and the manufacturing processes to the product's use, ending finally with its

disposal (Fleischer and Grunwald 2002). In many areas, however, nanotechnology is still in an early phase of development, so that the data about its life cycle that would be needed for life cycle assessment are far from being available. Empirical research on the persistence, long-term behavior, and whereabouts of nanoparticles in the environment as well as on their respective consequences would be necessary to enable us to act responsibly in accordance with criteria of sustainable development.

The Office of Technology Assessment at the German Bundestag

The Office of Technology Assessment at the German *Bundestag* (Büro für Technikfolgen-Abschätzung beim Deutschen Bundestag, TAB) was founded in 1990 and has become a permanent institution of the German legislature.[2] The purpose of the TAB is to provide contributions to the improvement of the legislature's information basis, in particular, of research- and technology-related processes of parliamentary discussion. Among its responsibilities are, above all, drawing up and carrying out TA projects, and—in order to prepare and to supplement them—observing and analyzing important scientific and technical trends, as well as societal developments associated with them (Monitoring). Since 1990, the TAB has been staffed by the Institute for Technology Assessment and Systems Analysis (ITAS) of the Karlsruhe Institute of Technology (KIT; formerly Research Centre Karlsruhe). The 20th anniversary of TAB was celebrated in 2010 in a ceremony conducted by the President of the *Bundestag*.

The TAB is oriented strictly on the German *Bundestag's* and its committees' information requirements. The TAB's principal is the Committee for Education, Research, and Technology Assessment. The choice of subjects for TA projects as well as their delimitation and specification is the *Bundestag's* responsibility. Decisions on the urgency of problems and the scientific advice desired belong on the political agenda. The choice of topics and of problems to be treated is primarily a political responsibility.

The decisions made in the preliminary stages of a TA project have decisive influence on the results obtained and on determining which questions can be answered. With the design of a TA project, it is also determined which aspects of the investigation, which interactions, or which segments of a subject area are relevant for the desired analysis or problem solution, and which are not. Preliminary decisions about the scientific disciplines which are to participate in providing information and on the experts to be consulted also belong in this category. These preliminary decisions are frequently made by TAB, in a close dialogue with the

[2]This section is a modified version of the corresponding section in Grunwald (2003) where TAB's work was analysed with respect to expectations concerning "democratizing expertise".

legislature, in particular with the group of rapporteurs which is in charge of taking care about the many interfaces of the Committee and TAB. In order to support this process, TA investigations are often carried out as so-called pre-studies, the purpose of which—besides an initial appraisal of the state of research—consists in a transparent, comprehensible, and purposeful inquiry into the possible research designs, the formulation of questions, goal directions, etc. The legislature then has the opportunity to decide on a reflective clarification of the subject matter and the design of the respective TA project. Treatment of the topics set in this manner by the legislature is carried out by the TAB in scientific independence and neutrality (Grunwald 2006).

The TAB is a small unit (at present, ten scientists). The various requests and topics are treated by obtaining a number of expert opinions on the respective subject from scientific institutions. The results of this groundwork are evaluated by the TAB-team, are concentrated on the legislature's advisory requirements, and are summarized in the form of a report to the legislature. By means of this networked method of operation, the pertinent competence and knowledge of the science system can be mobilized, case- and subject-specific, for the legislature's purposes in decision-making. The results of TAB studies sometimes lead to *Bundestag* resolutions, and sometimes they have indirect influence on processes of opinion formation and decision-making in the legislature.

The subjects of the TAB's studies stem from all fields of technology. The "classical" TA subjects, such as technology and the environment, energy, and bio- and genetic engineering, predominate. There are also studies on selected fields of science and technology (e.g., on new materials) and on new and emerging technologies such as nanotechnology or synthetic biology. An increasing share of studies on medical technology (Health Care Technology Assessment) and on Information Society issues can be observed in the recent years.

Sustainability Issues at TAB: Some Examples

The leitmotif of Sustainable Development leads to challenges for nearly all fields of policy-making, far beyond being merely a new phrase for environmental protection (Grunwald and Kopfmüller 2012). The following selection of finished or ongoing TAB projects might be a bit arbitrary because sustainability is an issue in most of the TAB studies.[3] The main criterion of selection was to show the thematic diversity of sustainability research at TAB.[4]

[3]This section and the following one are based on the corresponding sections in Grunwald (2011).

[4]For more information see the homepage of TAB (www.tab.beim-bundestag.de) which includes English versions of the Work Programme and of the summaries of finished projects. The descriptions given at the following pages are short versions of the information which can be found there. Also contact persons can be identified and approached via TAB's homepage. The full text of finished reports is available for download (German language).

Electric Mobility Concepts and Their Significance for the Economy, Society and the Environment (Ongoing)

Over the last few years, electric mobility has once again been the subject of lively discussions due to new, more powerful rechargeable batteries and the high volatility on the oil markets. Political objectives such as reducing the dependency on oil, more efficient energy transformation, significant CO_2 reductions and lowering local emissions from transport are important drivers of electric mobility. Electric mobility is therefore a prominent topic in sustainability discussions on the future of mobility and of the energy infrastructure.

A series of challenges still have to be solved. The lithium-ion battery which is deemed to be the key technology today still has to be substantially improved with regard to costs, energy density, weight, cycle and calendar life, and speed of charging. A charging infrastructure has to be implemented and business models have to be developed. For electric mobility services to be successfully diffused and used, it is imperative that these are aligned to their users and take their needs and preferences into account. Actually, there is high uncertainty concerning most of these challenges.

Policy support can make a decisive contribution to solving these challenges. Electric mobility is already being promoted by the German government in numerous research programmes and pilot projects. However, there has been no comprehensive compilation of the currently available results up to now. The main task of this TAB project will be providing such an overall picture which is essential for a wide-ranging discussion and evaluation of electric mobility and for any decision about political objectives and measures in this context. Conclusions and recommendations will be derived for the further development and promotion of electric mobility in Germany. The following steps are planned:

1. Establish the foundations for a comprehensive evaluation of electric mobility. This starts with an extensive description and analysis of the technologies and applications regarded. The focus here will be on vehicles with traction batteries (plug-in hybrids and battery electric vehicles). Hydrogen-powered fuel cell vehicles are included for comparison. Promising market penetration scenarios and transport concepts for integrating electric mobility into today's transport systems are described and analyzed. The impacts of electric mobility on local authorities and cities are considered as is their role in introducing electric mobility. Finally, energy scenarios for the improved integration of fluctuating renewable energy sources due to the use of electric mobility are described and analyzed.
2. Evaluate comprehensively technologies, applications and development scenarios with regard to sustainability aspects such as greenhouse gases, air pollutants and noise over the life cycle of batteries and vehicles, critical raw materials, opportunities and risks of shifts in the automotive value added chains and their impacts on Germany as an automobile producing country, effects of electric mobility on employment, road users' acceptance of electric mobility as well as expected impacts on their mobility behavior.

3. Provide an overall assessment of electric mobility and its potentials and draw conclusions. Different support strategies and measures are described and critically assessed. Finally, conclusions and recommendations are derived for the further development and support of electric mobility in Germany.

Ecological Farming and Biomass Production (Ongoing)

The national sustainability strategy of the German government includes the aim of increasing the proportion of ecological farming in the next few years to 20 % of productive agricultural land (from 5.4 % in 2008). At the same time, the share of renewable energy in primary energy consumption shall be increased to 10 % and in gross electricity consumption to at least 30 % by the year 2020. Biomass represents the most important renewable energy source, accounting for around two-thirds of the whole.

Provision of bio-energy depends increasingly on the agricultural cultivation of energy crops. This cultivation also covers areas which were previously used for food production or were part of set-aside schemes. At the same time, ecological food production requires a larger land area per unit produced compared to conventional production. These developments indicate increasing competition concerning land use. Analyses carried out by TAB in the context of the most recently concluded project »Opportunities and Challenges Facing New Energy Crops« have shown that the future development of competition for acreage is dependent on a multitude of factors.

The aim of the TAB project is to examine whether ecological farming and biomass production for energy and material purposes can be interconnected more closely in order to satisfy a growing demand simultaneously in both areas or not. If the latter is true, a priority would have to be set either on ecological farming or on biomass production. There will be the following focus points of investigation:

- Competition between the two sustainability aims of ecological farming and energy crop use as part of renewable energy production (in particularly acreage requirements under different conditions).
- Determining reasons and impediments to changing over to ecological farming in the past few years (for instance, influence of the spread of energy crop cultivation)
- Opportunities for integrating bio-energy production and energy crop use in ecological farming and their effect on acreage requirements and ecological system benefits.

Reduction of Land Use Rate: Objectives, Measures, Impacts (Finished in 2005)

The high consumption of land for settlement and transportation is a significant problem on the route to sustainable development. Soil as an environmental

medium is a non-reproducible resource which is one of humanity's finite natural assets fulfilling many essential functions. Land cannot, however, actually be »consumed« in the proper sense of the word, but it can be used in such a way that the spectrum of future opportunities for use is significantly restricted. As the supply of land is limited and non-reproducible, the various types of utilization are in competition with each other. As the ecological value of the soil is not generally reflected in the real estate price, land is frequently consumed in the »ecologically wrong place«. A regionally differentiated approach is required, which takes the different quality, carrying capacity and susceptibility of soils into account. The overarching goals of sustainable development have to be the maintenance of the multifunctionality of soils, the protection of open spaces and the pursuit of a land reserves policy, which also opens up the broadest possible range of possibilities for use to future generations.

The final report on the TAB project »Reduction of Land Use Rate—Objectives, Measures, Impacts« is not concerned with an analysis of the usefulness of the »Target-30-ha« of the German sustainability strategy or with alternative types of land use. The report is more concerned with a critical discussion of instruments and measures with regard to their contributions to the achievement of objectives.

Internet and Democracy: Analysis of Network-Based Communication from Cultural Aspects (Finished in 2005)

This TAB study addresses the impacts of Internet communication on democracy and its cultural foundations. The approach to this diverse topic is shaped by the following questions:

- How is the Internet changing the technological possibilities for political information, communication and participation?
- What cultural changes induced by the Internet are evident with consequences for political communication?
- What visions and potential of the Internet for democracy and what related concerns have been and are being discussed in the academic literature, and how should these be evaluated today?
- How are institutions of the executive and parliament viewing and using Internet communication? How far is this contributing to achieving the democratic potential of the Internet?
- How are civil society actors using the Internet for political communication and what change is this leading to in the political public? How true is the idea of the Internet as a new form of political public (public on the net)?
- Where is there political need and opportunity for shaping this, specifically at the German Bundestag?

The leitmotif of sustainability is touched by these questions mainly by equity issues concerning the access to information and communication technologies

(the digital divide issue) as well as via the exploration of the potential of the Internet for approaching some of the social dimensions of sustainable development such as enabling far-reaching participation. In this project, there is a direct link to culture, in particular to cultures of political communication and its changes in the Internet age.

The Internet is accordingly investigated as a possible medium for supporting and strengthening democracy. In dealing with skeptical assessments and concerns on the one hand and high-flying visions and expectations on the other hand, the report (Grunwald et al. 2006) seeks realistic answers to the question of the Internet's impact on political communication and democratic culture. The line of argument in the report is:

- start from the normative paradigm of a deliberative democracy which is solidly justified by democratic theory and rooted in political discourse and culture;
- look at the Internet's possible contributions for achieving these normative concepts;
- review the reality of political Internet communication and study if and how far this potential is already realized;
- identify promotional factors and also obstacles which have so far prevented implementation;
- use this as a basis for identifying political opportunities for action. In particular proposals were made toward the implementation of petitions to the *Bundestag* via the Internet which had remarkable influence in the last years. E-petitions were established at the *Bundestag* and opened up a new window for political communication between members of parliament and citizens.

Internet Communication in and with Developing Countries: The Example of Africa and Opportunities for Development Co-Operation (Finished in 2008)

Since the 1990s Africa has moved back up the political agenda—above all as a result of the United Nations Millennium Declaration and African reform and unification aspirations. On the other hand, the use of information and communications technologies to promote social development continues to remain marginalized in the discussion on international development policy. In this field primarily the sustainability dimension of intra-generational justice is addressed by looking at development challenges, opportunities and strategies.

The topicality of the issue is demonstrated by looking at the current programmes and strategies pursued by African states and regional organizations, at the practice and statements made by the institutions of African civil society, as well as at the local, in part extremely rapid development of the Internet and mobile telephony. German development policy and cooperation will have to continue to occupy itself with this issue and to clarify its own strategy simply because of the

interest in Africa itself in the implementation of information and communications technologies for the promotion of development.

The TAB report addresses the reality and potential of Internet use in sub-Saharan Africa giving emphasis to the issues of democratic development, government action and civil society; economic development and trade as well as to education, research and technological development. The focus of the investigation is on Internet use which is not viewed as detached from other conventional (e.g., radio and television) and modern (e.g., mobile telephony) information and communications technologies. The analysis is thus also a contribution to the overall discussion on the use of information and communications technologies for development (ICT4D).

Future Trends in Tourism (Finished in 2006)

Demographic, socio-structural and socio-cultural developments have always led to changes in tourist demand and faced service providers in tourism with substantial need to adjust. These constant challenges have expanded and intensified considerably in the first few years of the new millennium. War and tourism, extreme weather, the ongoing internationalization of tourism and the aging of society (increasingly prominent in public awareness) have emphatically demonstrated the latent vulnerability of tourism as a boom industry. The survival of the tourist industry depends, on the one hand, decisively on recognising relevant trends and allowing for them in good time. On the other hand, tourism is related with many sustainability issues and goal conflicts which make this field to a prominent area of study also with regard to sustainable development.

The focus of the TAB project "Future trends in tourism" was addressing the themes "demographic change", "EU expansion" and "security, crises and dangers". The report

- identifies the relevant trends and their implications for tourism in Germany and by Germans, on the basis of a review and an analysis of current socio-demographic data;
- looks at the impacts of the eastward expansion of the EU and considers what trends in vacation traffic can be expected in and from the new EU nations and to and from Germany;
- describes current and future potential dangers to tourism and discusses possibilities for improving information, prevention and crisis management.

These three themes raise numerous important research issues. For example, interdisciplinary approaches could monitor and analyze the demographic shift periodically, taking into account tourist aspects such as the development of travel motivation and behavior in different age groups. In expectation of growth in tourism from the EU expansion, the consequences of this could be explored in dialogue between politics and science, for example if and how framework conditions

could be created which increase travel to Germany. Research into risk and consequences should analyze and evaluate future tourism in the shadow of possible structural global peacelessness, the consequences of climatic change and growth in epidemics. Finally, all these trends and challenges should and could be assessed with respect to sustainable development in order to allow designing pathways to establishing a more sustainable culture of tourism.

These examples show the rich diversity of sustainability issues dealt with at the German Bundestag and its Office of Technology Assessment. More or less, the cultural dimension of sustainability is present in most of these studies. However, mostly this is only the case in form of a cultural "background" of sustainability, while other sustainability aspects such as environmental issues, challenges of future responsibility or equity are in the foreground.

Sustainable Development at Parliaments: A New TAB Project

In this cross-cutting project addressing the question in which way and by which means parliaments can (better) tackle challenges of sustainable development, more emphasis will be given to the relations between sustainability and culture, in particular with respect to political and democratic culture.

Following the UN Earth Summit in Rio in 1992, a great variety of activities were initiated in politics and society all over the world. Quickly, it became clear that the political perception and realization of the goal of sustainability pose far-ranging challenges to governments and parliaments, specifically to their established procedures and to their organization based on a division of labor. The long-term trends of social development and the effects of political measures must be identified and taken into account. Political actions must be coordinated among numerous affected departments. A high degree of coordination with special interest groups in society is necessary if long-term goals affecting more than one area of policy are to be achieved. To this end, procedures as well as forms of institutionalization (e.g., interdepartmental programs, creation of specialized scientific institutes, boards of inquiry, expert committees, communication fora between politics and society) have been established by parliaments and governments in many European countries.[5]

The politics of sustainability has provided new momentum for the long-term orientation of politics and the formulation of corresponding goals in all countries. Awareness of long-term and interdepartmental policy formulation has been sharpened and has led to new forms of » governance". A TAB report (TAB working

[5]The European Parliamentary Technology Assessment institutions constitute the EPTA network. See www.eptanetwork.org for information about the European landscape of parliamentary TA.

report no. 86 published in 2003) confirmed that both the initiative and the further development of sustainability policy are essentially carried by the executive. At governmental level, sustainability policy has led to new administrative structures (specific supervisory responsibilities in the Department of the Environment) and to the installation of new institutions (e.g., sustainability councils and task forces in the ministries such as "Green Cabinets"). The role of parliament, in contrast, seems to lie merely in accompanying and supporting the policy of sustainability. Its role as a forum for public consultation and as a body supervising the executive probably, however, does not exhaust the potential of parliament, according to the results of the TAB study mentioned above.

On the other side, the German *Bundestag* has, compared with many parliaments in other countries, made a considerable contribution to national sustainability policy, in particular by creating the Commission of Enquiry on »Protecting People and the Environment« as well as appointing the parliamentary advisory body on sustainable development (see Ulla Burchardt in this Volume). A range of measures can, however, further strengthen its role in German sustainability policy, ranging, for example, from exercising its budgetary powers more strongly to control governmental programmes and draft legislation with regard to their contribution to promoting sustainable development, to regular plenary debates on the status of German sustainability policy and finally to intensive use of the options for monitoring the sustainability of laws and programmes (Grunwald and Kopfmüller 2007).

In this new TAB report, an overall review and some country studies are planned, the latter as examples that analyze in depth how the parliaments in other countries have initiated institutional innovation and learning processes. These should then be examined with regard to whether they can be transferred to the structures and procedures of the German Bundestag. Against this background, some institutional and procedural options to strengthen the role of the German Bundestag will be identified. Three basic focal points of parliamentary work are of particular interest in this context:

Accompanying the work of the government on the topic of sustainability and supervising the work of the government from the perspective of its contribution to sustainable social development;

Participating in a substantive sense in the further development and implementation of sustainability strategies (definition of sustainability goals and measures, proposals for legislation with particular relevance for sustainability policy;

Stimulating and supporting social discussion about sustainable development by handling sustainability issues in a prominent and public manner and by establishing the principles of sustainability, such as by means of participation and communication in the work of parliamentary agencies and committees (councils, hearings, and commissions of enquiry).

In doing this, a considerable contribution to a "culture of sustainability" shall be made at the level of parliaments.

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