Fritz Gloede

Technology policy, technology assessment, and participation

Technology assessment (TA) is on everyone's lips, participation was on everyone's lips, and participation in TA is a matter of course. The question, as Scharioth explained in 1983, was only "where," "when," "with whom," and "how"? (Scharioth 1983). However, a second "sociological" look, which many people take following Luhmann (e.g., Luhmann 1984), reveals that this self-evidence is not very instructive and conceals divergences.

I would like to make it plausible that the demand for participation in TA is context-bound and can therefore take on different meanings. I will try to illustrate this using the example of the TA project "Herbicide Resistance" [HR] (van den Daele 1994).

Finally, the question should then be raised as to which realization conditions a discursive participation concept is practically bound to.

1. Participation as a program

> If someone were able to reconcile industry operation requirements and public participation in such a way that everyone would be satisfied it would be worth an exceptional award for miraculous achievements (O.H. Wildgruber, in: OECD 1993).

Naschold described "publicity and participation in TA" as one of three fundamental problem areas that are "largely unresolved," "latent," and at the same time "highly explosive." Superficially, it is only about the function and recruitment of advisory boards, publication rights, and the public discussion of study results, the pluralistic representation of social groups, or the inclusion of decentralized groups in the implementation of studies. In reality, however, these are language games or *dilatory formula compromises* that conceal deeper social lines of conflict. The political system fears a challenge to central state structures from extra-parliamentary plebiscitary movements or a "radicalization of the network approach." The economy fears the trend toward "co-determination" for society as a whole and "forward-looking political technology design" – in other words, a regulatory revolution. Accordingly, the topic – also internationally – tends to

be marginalized, usually not thoroughly discussed, and regulated restrictively in practice (Naschold 1987, p. 21ff.).

For this reason alone, it is inadvisable to reduce the issue of participation to the question of why the rhetorical consensus on participatory TA has not been put into practice and which pragmatic limitations may be responsible for this (e.g., lack of time and money, cf. Jochem 1988). On closer inspection, it becomes clear that the supposed consensus is already fragile in programmatic terms. Depending on the image of society and the "political target system" (Böhret/Franz 1985), different things are meant and intended when participation in TA is called for. It is very important, for example, whether this program point primarily:

- is about TA itself as a process of problem-oriented and consultation-based *research*,
- is about state *technology and industrial policy* as a decision-making and control process, or
- refers to "TA processes" as a model of *social learning* in the medium of the public sphere.

Many works on the program and practice of TA do not make such distinctions. This may be due not least to the multidimensionality or vagueness of the concept of participation. Used in the sense of "taking part," "participation" leaves it largely open as to who participates in what role or function and in what way.

In this context, I cannot go into the socio-historical changes in the concept of participation and democracy (cf. Rammstedt 1970). However, I would like to criticize a form of justification for participation in TA that collects all possible arguments with a normative background conviction without considering their different and sometimes contradictory contextual references (Lohmeyer 1984; Fiorino 1990). As we know, the formula "a lot helps a lot" does not always apply in everyday life either. To put it bluntly, one could argue that

- participatory TA does not make technology policy democratic, and
- democratic technology policy does not necessarily require participatory TA!

The difficulties with arguments such as Lohmeyer's only really become clear when two further lines of reasoning for participation are introduced in addition to the democratic requirement, namely:

- functional justifications (frame of reference: decision), and
- cognitive justifications (frame of reference: research).

Functional justifications for participation in TA are familiar in the TA debate. They are aimed at improving the possibilities for implementing the results of decisions, facilitating consensus on controversial issues, and ultimately generating public acceptance for technology development and technology policy decisions.

Beyond the question of its realizability, such a promise contradicts Lohmeyer's warnings against reducing TA to the procurement of acceptance, and his normative postulates of democracy.

The third line of reasoning, namely that participation could mean considerable information gains for TA (by involving "affected parties" as the experts on their own affectedness), also lies alongside the democratic premises. In this perspective, the "participants" become objects of research rather than being accorded subject status in the sense of decision-related participation (cf. Bechmann/Gloede 1986; Gloede 1987).

Well-meant intentions can thus lead to fragile and partially contradictory justifications for participatory TA, because the advocated participation refers to three participant roles at the same time: the role of the decision-maker, the role of the decision addressee, and the role of the object of decision-preparatory research.

2. Three justification contexts for participation

In view of these difficulties, I argue in favor of explicitly distinguishing between the justification contexts for participation in TA that I have indicated. These contexts of justification are related to general concepts of scientific policy advice.

- The first justification sees *participation in TA as a functional requirement* and focuses primarily on functions of cognitive decision-making preparation. Here, TA mediates between science and politics.
- The second context of justification sees *participation in TA as a democratic political demand* and corresponds with the idea of TA processes as socio-political arenas. Here, TA mediates between the public and politics.
- The third context of justification sees *participation in TA as an element of discursive mediation* of controversial cognitive and normative validity claims. TA as a model of "social learning processes" mediates here between science and the public.

2.1 Decision rationalization

The reference points for a *functional justification of participation* can be seen in the objectives of the classic TA concept.

Participation should contribute to the "completeness" and balance of the analysis; informing *the* public should contribute to the objectification of opinions; information *from the* public could contribute to early warning, and the involvement of those affected in the TA processes should increase the willingness to accept the decisions discussed in this way.

In short: Participation is related to the rationalization of (political) decisions and must be realized *in accordance with this requirement.* In this respect, it varies depending on the topic and situation; participation "rights" cannot be asserted. The selection of those to be involved can be subject to cognitive and political-strategic criteria in equal measure. All scientifically "irrelevant" contributions and/or all politically "irrelevant" decision addressees tend to be excluded. Under certain circumstances, however, this can be associated with competence problems (in the case of expert dissent) or legitimacy problems (in the case of normative dissent) (cf. Throgmorton 1991).

Which participation criteria are in the foreground for which phase of TA implementation (problem definition, problem processing, discussion of results) also depends on the preferred consultation models (Habermas 1964). A more "decisionist" concept is generally associated with a scientistic understanding of TA (cf. Gloede 1992) and will therefore primarily favor cognitive criteria for participation. The consideration of expert dissent is then rather unlikely, since scientific uncertainty is either to be resolved by research or made clear by limiting scientific validity claims. In contrast, political-strategic participation criteria are left to the considerations of the decision-makers.

A more "technocratic" concept is likely to shift the absorption of uncertainty more into the area of scientific problem definition and processing, and instead define political-strategic participation criteria very restrictively. There is little room for normative dissent where practical constraints prevail.

Finally, a more "pragmatic" concept would have to take little account of the distinction between scientific and political-strategic participation criteria and could be realized, for example, in the formation of hybrid communities of experts and decision-makers whose composition takes equal account of both sets of criteria.

2.2 Democratization

The points of reference for a *democratic-political justification of participation* must be sought in those normative premises and political preferences whose representation and implementation in decision-making is sought in TA processes. This involves both the identification of legitimate normative concerns and the realization of appropriate procedures for social decision-making.

Participation in TA should guarantee the opening up of technological and socio-political alternatives and at the same time ensure the democratic participation of the population or social groups previously excluded from decision-making. From this perspective, the demand for participation is usually closely linked to the expectation that the results of democratic TA processes are "consistently" translated into political decisions.

This justification for participatory TA thus corresponds to the demand for participation in decision-making – not only in the traditional political sphere. Accordingly, it must be based on democratic norms that can vary between a more policy-centered and an extended "social" understanding of democracy. This results in considerable differences with regard to the political-social participation criteria. In this respect, this context of justification generally faces the problem of justifying its participation criteria and procedures vis-à-vis the prevailing forms of democratic participation and, in particular, those of representative democracy (cf. Guggenberger/Offe 1984). Such justifications can take both "elitist" and "plebiscitary" directions.

"Elitist" justifications for supplementation or expansion correspond with a scientific normativism (cf. Gloede 1992) and tend to assert the consideration of concerns that limit the validity of the democratic majority rule, but which are essential for a substantial orientation toward the common good. This line of justification of participatory TA therefore usually also has rationalist implications. The difference from functionally-based TA participation is perhaps that a "social rationality" should take the place of a "technical rationality" (cf. Gill 1991). Critically, one could speak of a concept of technocracy extended by the "social."[1]

1 An objection to this interpretation of a normative concept of social or especially constitutional compatibility has been that it is rather an analysis of the normative or constitutional implications, which in this respect only aims to make a contribution to the democratic discourse, but in no way intends to directly determine political action (Roßnagel 1993, p. 200ff.). Even if the analysis of normative implications thus wants to withdraw into the general framework of technology assessment, the concept of constitutional (in)compatibility must remain ambiguous. Violations of values and norms in this

"Plebiscitary" justifications for supplementing or expanding democratic participation, on the other hand, correspond to political normativism and are therefore entirely compatible with a decisionist definition of the relationship between science and politics. In general, they are based on a critique of representative-democratic institutions that asymmetrically ignore societal interests. With regard to participatory TA, concern in this context is directed toward the participation of non-organized interests and concerns, which have so far been accorded neither articulation nor representation (due to a lack of conflict capacity) (cf. the institutionalization concept of the "Greens" in: Deutscher Bundestag 1989).

The scientific participation criteria, on the other hand, appear to be of secondary importance in a democratic context. In contrast to criticizable objectivity postulates of traditional TA, the focus here is rather on a concept of advocacy TA, according to which all socially legitimate concerns legitimately seek their cognitive underpinning. In this respect, the safeguarding of TA participation must primarily focus on the accessibility of expertise as a resource (cf. Schevitz 1992).

2.3 Social learning processes

A comparable openness toward different concepts of deliberation cannot be assumed for the *discursive justification of participation*. Insofar as it is based equally on questionable cognitive *and* normative validity claims, it not only excludes scientistic or normativist understandings of TA. It is also incompatible with decisionist or technocratic conceptions of science and decision-making.

When controversial normative preferences and political positions wrestle argumentatively over "correct" decisions and "robust" assessments (cf. Rip 1987) within the horizon of scientifically contested knowledge, scientistic and normativist claims are balanced, as it were. The normative integration of scientification requires participation according to socio-political criteria, while scientific dissent requires participation according to cognitive criteria.

The TA process – it could be pointed out – becomes a "domination-free" discourse in a double sense: All social interests, normative demands, and scientific views have the same opportunity to participate, but the decision-making reference of TA appears considerably loosened.

However, the "latency" of the decision reference of discursive TA (van den Daele 1991, p. 40f.) has reasons other than those found in the case of a strategic

---

dimension still seem to force political or legal decisions rather than putting them up for discussion (cf. also the criticism in van den Daele 1993, p. 220ff.).

TA concept, which is also not directly decision-forming in its orientation toward the "knowledge base of decisions." Discursive TA aims to generate arguments that are oriented toward standards of social justice, political legitimacy, and scientific competence. Since consensus on equally legitimate and competent conclusions will not necessarily be achievable, or will not be achievable within the time frames required for practical decision-making, the results of TA discourses can rarely satisfy criteria of "practicability" (Throgmorton 1991). The initial conditions for discursive TA processes, namely the social and scientific openness to participation, also have a restrictive effect with regard to "practicability." This is because the practical consideration of argumentative positions that were previously socially or politically marginalized already implies a shift in power and domination relations. To expect this from discursive debates would not only mean indulging in idealistic or rationalistic ideas (cf. also Gill 1993a).

For even if a consensus were reached, there would be no guarantee that this consensus of the participants in the discourse would successfully pass through democratic procedures. What's more, a consensus that could in principle be reached through discourse would ultimately suspend democratic decision-making by making it superfluous.

Conversely, it can be concluded from this that a discursive justification of participation against the background of desired social learning processes is fundamentally compatible with different ideas of democracy.

The implications of the discursive TA concept for participation criteria are thus also more clearly outlined. Similar to a functional justification for TA participation, this raises the question of the relevance criteria for participation. For although the discourse concept excludes political-strategic considerations regarding the participation of "powerful" social actors and "influential" scientific positions (cf. Ueberhorst 1990), this does not result in any positive relevance criteria. The same applies to the exclusion of democratic criteria of quantitative representation. Equal opportunities for the discursive exchange of arguments means not only disregarding the different social power of controversial positions but also their different political supporters in the population. This also does not result in any positive criteria for the selection of the positions and concerns to be included.

Finally, a discursive determination of selection criteria for discourse participation would not be a viable perspective either, but a circle of justification. The discursive justification of participation must therefore refer to non-discursive participation criteria. Ultimately, the ability to articulate positions must be empirically presupposed and it must be relied upon that the problem-specific selection made does not encounter social contradiction.

It should have become clear that functional, democratic-political and discursive justifications for participation in TA have significantly different implications for participation goals, participation criteria, and, in some cases, for participation procedures. In addition, they are open to varying degrees to common consultation concepts (relationship between science and decision-making) and concepts of socio-political consideration of interests (relationship between the public and politics).

However, the systematic incompatibility of participation contexts does not exclude the possibility that participatory TA processes of different types may practically coexist in society. A practical coexistence can be assumed because the types of TA mentioned are related to different problems that are perceived with different frequency:

- strategic TA projects with functionally based participation are aimed at the internal rationalization of decisions by organized actors or social subsystems;
- democratic TA processes aim to extend the legitimacy of socio-politically far-reaching decision-making;
- discursive TA processes with qualitative participation criteria are aimed at restoring fragile social integration as a prerequisite for democratic decision-making, not at decision-making itself.

However, discursive attempts to generate argumentative consensus do not necessarily have to end with a "consensus on the matter." An understanding of areas of consensus and dissent and their reasons, i.e., the creation of a "rational dissent" (Miller 1992), can also serve as a driver of social learning processes and, as a "second-order consensus," can be a sufficient basis for the re-establishment of decision-making ability.

Empirically, strategic TA processes are the rule, whereas democratic or discursive TA processes are the exception (see Sec. 4). However, an elementary condition for the success of *all* processes is likely to be a prior agreement among the participants on the underlying problem situation and thus on the desired character of the TA process.

The following discussion of the TA project on herbicide resistance shows the dissonance that can arise if this condition is not met.

3. The TA project "Cultivation of crops with genetically engineered herbicide resistance"

> The so-called consensus theory is an invention of people who are all gifted polemicists. They combine their desire for general agreement with the threat of declaring the unwilling to be evil or imbecile. Since then, we have had to be doubly careful when they majestically call for consensus. [...] What happens anyway should not just be accepted. What had been tacitly assumed, the so-called acceptance, is now expressly requested (Konrad Adam, FAZ of May 24, 1991).

In contrast to the social debate on genetic engineering, which goes beyond technology-specific aspects to include general problems of industrialization and technological development, the debate on appropriate state regulation of the use of genetic engineering focuses on legally-required risk prevention and risk precautions. The biological risks of genetic engineering and measures to ensure biological safety are of central importance for the protection of fundamental legal interests such as life, health, public safety, and the environment.

The discrepancy between the extensive expectations and fears expressed in the societal debate on genetic engineering on the one hand, and the extensive limitation of state technology control to safety precautions on the other, has led to increased expectations regarding the implementation of technology assessments on genetic engineering.

In view of the current state of the debate against the backdrop of the advancing use of genetic engineering, it has been postulated on various occasions that the time of fundamental controversies is over. The original polarization between fundamental supporters and opponents has now receded behind application-related differentiations, and it is now more important to carry out concrete TA studies on specific fields of use. The TA project on herbicide resistance in genetically modified crops (HR project), which was launched at the Berlin Social Science Center (WZB) in 1991, was thus in tune with the times, so to speak. It seemed to be both an expression of and a driving force behind an increasing objectification of the controversy, which has now been going on for almost 20 years.

However, the disputes surrounding the 1993 amendment of the German Genetic Engineering Law (Gentechnikgesetz, GenTG) make the diagnosis of objectification appear somewhat premature. Both supporters and opponents of genetic engineering and its "deregulation" expressed a considerable degree of emotionality and moralization.

Shortly after the GenTG came into force, an article in the newspaper "Frankfurter Allgemeine Zeitung" (FAZ) stated that the "dispute about playing with

genes" had become less heated, but the contradiction remained. The course of the HR project also confirms this.

At first glance, the HR project was designed as a discursive TA. Neither a scientistic limitation to the generation of scientific expertise nor a normative representation of controversial decision-making claims was intended (van den Daele 1994; cf. also van den Daele 1991, p. 40f.). The planned TA procedure was to be a "discourse arena," so to speak, "in which the range of social conflicts surrounding genetic engineering is reflected" (van den Daele 1991, p. 39). The participation problem was perceived accordingly. Instead of democratic-political criteria, recourse was made to discourse-theoretical participation criteria; an attempt was made to qualitatively represent the argumentative positions in the concrete field of conflict, both in socio-political and scientific terms. It had already been recognized in advance that selection criteria based on discourse theory could hardly be justified discursively and could at best be partially corrected in a discursive TA process itself (van den Daele 1991, p. 42). As the practical implementation of the HR project showed, the selection criteria were relatively uncontroversial. After all, the basic principles of the planned procedure design also met discursive requirements: This was because the participants in the HR project were to be able to influence the formulation of the questions and the rules for their processing (van den Daele et al. 1990).

In addition to conducting the discourse on HR technology itself, a key objective of the project was its accompanying investigation by the WZB. Paths were to be sought to find a way between mere adaptation to a natural innovation race and an unproductive blockade of further development. The investigation into "how problem perceptions, argumentation, and conflict patterns change under the influence of the TA process" (van den Daele et al. 1990) was therefore already set along a pathway.

The accompanying research was guided by the hypothesis that factual rationality in dealing with HR [herbicide resistant] plants was most likely to be achieved via the social dimension (discursive procedures). Scientific ambivalences had to be "bridged socially, i.e., by consensus" (ibid., p. 14).

The withdrawal of the environmental groups (AbL et al. 1993) during the final conference should not necessarily be interpreted as a failure in the context of procedural "rationality gains," but rather in the context of the intended "impact" on the initial social conflicts (van den Daele 1994).

First conclusions on the functioning of discursive TA procedures have previously been drawn with a not inconsiderable amount of sociological conceptualization (Bora 1993; Bora/Döbert 1993). Their formal status is that of a sober

examination of initial hypotheses. Their political core, however, seems to be disappointment about the political failure of a strategy (van den Daele 1994). In contrast, the thesis here is that the implementation of the HR project was characterized by a confrontation between two irreconcilable TA expectations, for which "discursive" approaches could only represent an unstable bridge.

With recourse to the typification developed so far, it could be argued that the project as a whole was characterized by the *conflict between a strategic and a democratic TA concept*, which not coincidentally coincides with the fronts in the genetic engineering conflict itself.

The spokespersons of the environmental groups clearly articulated themselves as representatives of a democratic TA concept (Gill 1991, 1993a; Kiper 1993a, 1993b). Here, "participatory TA" was to have an explicit influence on technology design, i.e., on decision-making. According to this guideline, it was already considered at the beginning of the procedure whether the required participation effort could be reconciled with the expected political yield (Gill 1991) – a legitimate tactical calculation, which was also related to the special participation requirements of the represented organization.

The *participants from industry and public authorities* will also initially have been faced with the question of why they should enter into such a procedure and which interests they should take into account. Such considerations inevitably take place regardless of whether the procedure in question is an event for political and administrative decision-makers or a discursive TA program remote from decision-making (cf. Giegel 1992, p. 78f.). These groups of participants can be assumed to be representatives of a strategic TA concept on the basis of a classification made by Bora and Döbert with regard to the "discourse" typology they constructed. According to this, the participants from industry and public authorities are largely to be regarded as supporters of HR technology who at the same time advocate technical-scientific and/or procedural standards of cooperation in the TA process, with the aim of cognitive preparation of political decisions (Bora/Döbert 1993, p. 90). None of these participants are supporters of a democratic TA concept directly related to decisions. How could it be otherwise?

Interference in the economic or official "freedom of action" would, as van den Daele also sees it, deprive the TA process of its "business basis." Moreover, the non-binding nature of participation was signaled by the fact that the representatives of the authorities were not officially 'sent'. Against the background of current genetic engineering law, however, the desired restriction to "information orientation" not only has restrictive consequences for the function of the TA procedure to "serve as a forum for technopolitical conflict" (van den Daele 1994,

p. 116). It must itself be regarded as a political preference. The existing structures of technology regulation are thus not only unavailable for decision-making, but ultimately cannot be addressed discursively either. In this light, the orientation toward a "scientific type of discourse" proves to be just as political as the "political type of discourse."

While the *organizers of the HR project* initially appeared as representatives of a discursive understanding of TA, and this had in many respects become structure-forming, it must now be shown that the organizers were already entangled programmatically in contradictions between a strategic and a discursive concept, the practical elimination of which took place in favor of a strategic orientation.

I would like to make this assertion plausible on three levels:

- at the level of the problem perception, on which the HR project was based and which ultimately shaped the expectations of the TA process,
- at the level of the process design itself,
- at the level of the accompanying process monitoring.

3.1 Organization of social learning processes or "rationalization" of decisions made?

Insofar as there is an explicit perception of the problem in the context of the HR project, this perception appears ambivalent. On the one hand, reference is made to the central genetic engineering conflict in society, which should be clarified and structured with the help of TA procedures. The opportunity for social learning processes inherent in this should be utilized. Apart from the question of who explains and who learns, this perspective could be described as an orientation toward a latent "constitutional-political" function of discursive TA processes. They reflect background conflicts about fundamental questions of the relationship to technological development and nature, which are not only decided by "regulation," but also by changes in awareness and values (van den Daele 1991, p. 45).

According to van den Daele, the addressee of discursive TA is not the decision-maker directly, but the opinion-forming public. It is obvious to recognize "social integration" as an existential problem in this problem-description and functional definition of TA. Endangered social integration threatens to undermine decision-making ability per se. The aim of establishing consensus through discursive TA processes then concerns the restoration of the ability to decide between alternatives.

However, this functional definition of the HR project is now contrasted with the accentuation of TA as information procurement for the rationalization of (political) decisions (van den Daele 1994, p. 115ff.). Such a functional description is fully compatible with the prevailing "strategic framework concept" of TA and the corresponding functional participation criteria. It is rightly stated that "information orientation" in this context has been the "political business basis for the relative consensus" that "has led to the institutionalization of TA" (van den Daele 1994, p. 115). Concerns about TA institutionalization were based in fact on the risk of thereby creating "constitutional political" forums for fundamental social conflicts (cf. Naschold 1987; Rautenberg 1989).

Precisely because the Enquete Commission on "Genetic Engineering" (1984–1987; see Enquete-Kommission et al. 1987) and, following it (if not in compliance with all of its recommendations), the genetic engineering legislation, had now demonstrated decisions and thus the ability to make decisions, the organizers of the HR project should have asked themselves which social actors still shared the perception of a fundamental conflict in need of discussion. After all, the path "between a natural innovation race and an unproductive blockade" of genetic engineering use had practically already been taken. What else could rationalization and legitimization of decisions mean?

Significantly, however, a strategic TA concept, which would be appropriate at this point, is not consistently explicated. Neither in the project application nor in the reports on the project published to date is it apparent which political decision alternatives or which regulatory requirements the HR project was to be geared toward. It seems that this standard question of a traditionally decision-related TA procedure was largely left open in favor of the rather diffuse question of whether there was any need for political action at all. It is understandable that this is denied by those who do not see the "special" risks of transgenic crops.

It is therefore hardly surprising that the HR project developed into a virtual review of "application documents" in legally-regulated approval procedures. From this perspective, the "recognizable problems" could be reduced to "approval issues" – the question of whether the concept of an "additive" risk assessment on which this administrative approach was based could be appropriate (cf. Gloede et al. 1993) was and remained controversial as a reflection of the original conflict of principles.

There could therefore hardly be any talk of an overarching mapping of the social genetic engineering conflict, which also extends to moral aspects and in particular to weighing-up the presumed "opportunities and risks." "TA implicitly accepted the self-running course of technical change as a starting point" (van

den Daele 1994, p. 127). It thus more or less followed the basic conviction of at least one of the applicants, according to which resistance to new technology is the "inconsequential accompaniment to technical progress" (van den Daele 1988).

If the HR project could thus claim neither "constitutional policy" nor decision-related functions, and the information procurement organized in it was largely similar to that in approval procedures, it would not seem inappropriate to see its actual purpose in the testing of a hypothesis, namely the hypothesis that TA is suitable for "conflict management," i.e., that through scientific discussion in conjunction with procedural constraints it is able to "objectify" the initial conflict and "rationalize" decisions that have already been made. It is then consistent, despite the elementary information orientation of the project, to ultimately call it a "political (!) experiment." In *this* context, participation must be seen less as discourse-related and more as functionally justified.

Finally, with regard to conflict resolution and gaining acceptance through involvement in proceedings, the suspicion of a "modernization of the rhetoric of appeasement" (Gill 1991) can no longer be simply dismissed.

3.2 Problem-induced or technology-induced TA?

The previous discussion of problem perception and the corresponding TA function is reflected at the level of the project concept itself. In an event on technology assessment held at the Institute for Genetic Biology Research (Berlin) at the end of 1989, van den Daele emphasized that a "problem-induced" examination of alternatives to the genetic engineering HR strategy in agricultural weed control was undeniably legitimate (van den Daele 1990). It certainly does not follow from this that "technology-induced" TA is illegitimate. It is not a question of distinguishing between legitimacy and illegitimacy, but of problem adequacy. Apart from the fact that, in this light, "technology-induced" TA also presents itself in a specific sense as problem-induced TA (cf. Gloede 1992), van den Daele rightly notes that the comparison of alternatives between industrialized intensive agriculture and organic farming demanded by the environmental groups (cf. Gill 1991) would have meant a considerable extension of the problem, affecting fundamental regulatory and economic structures. The evaluation aspects and standards of comparison to be used would also have been different. However, this would have allowed the HR project to exemplarily take up the entire complexity of the genetic engineering controversy and to fill the "constitutional-political" dimension of discursive TA without risk under conditions of decision remoteness – an opportunity that is generally not given to strategic TA projects that are closer

to decision-making. Measured against this, references to financial restrictions or to analyses of "agricultural development paths" carried out elsewhere (van den Daele 1994, p. 115) must appear rather meagre. Finally, it should be noted that, also at the procedural level, a considerable restriction formed the starting point: In contrast to even "ideal concepts" of strategic TA, participation in the process does not extend comprehensively to the problem definition.

3.3 Normative or empirical consensus hypothesis?

One initial assumption of the HR project is that, in the face of cognitive uncertainty and scientific dissent, consensus in the social dimension is required as a bridging factor to enable decision-making. Where this consensus is no longer unquestionably present, it could possibly be established by implementing suitable procedures (van den Daele et al. 1990). At first glance, this consensus hypothesis on the performance of discursive procedures stands in striking contrast to the castigation of "consensus theory as a German ideology" (Döbert 1992) found elsewhere. In contrast to the efforts of a universal pragmatic discourse theory, which, as in the work of Habermas, theoretically assumes elementary consensus as a prerequisite for discursive communication about what is right and just, "factual rationality" plays a prominent role in the procedural theory of the HR project. To a certain extent, this was the medium in which politically polarized conflicts are made to "disappear" in the course of the TA process (Bora/Döbert 1993, p. 93). The constraints of the "truth-oriented discourse" had also become so strong empirically that it was not possible to adhere to the "political discourse" (ibid., p. 95).

Without being able to go into detail here on the conceptualizations of the relationship between truth, morality, and procedural participation, which are certainly not entirely consistent with the project (cf. van den Daele 1991, p. 18ff.), the "emphasis on the factual dimension of procedures" (ibid., p. 21) must nevertheless be surprising. This hypothesis appears paradoxical or leads to a circular reasoning. If it is the *limits* of factual rationality that are to be bridged by procedurally mediated consensus in the social dimension, it can hardly be this "factual rationality," which in turn represents the *medium* for creating social consensus in the procedure.

In the light of the now clear course of the proceedings, it becomes apparent that the observation of the proceedings and its hypotheses operate with a changing frame of reference. Insofar as the initial controversy about the HR project amounted to political dissent, this could by no means be made to disappear by

the constraints of the truth discourse. "Conflict resolution presupposes [at least, F.G.] that one agrees on what the case is" (van den Daele 1991, p. 19).

Since, in view of the preliminary decision in favor of a "technology-induced" TA, there was already no agreement on the problem that should constitute "the case" for the project, the prospect of a consensus-building influence on the initial conflict was already largely blocked.

The consensus on the given framework conditions, topics, and discussion procedures that could be observed in the further course of the process was also neither about the "matter" nor the "morals." Rather, it can be assumed that the participants were also able to make sense of even the narrowly defined procedure for different reasons. This "meaning" probably consisted of the expectation of being able to use the scientific controversy conducted here on specific terrain as a strategic resource with a view to the ongoing public conflict. This is supported in particular by the dispute over the final "reconstruction" of the discourse on the part of the organizers (van den Daele 1994, p. 134f.). For in the context of the public controversy, it certainly seems relevant whether the result of the project is a "confirmation" or a "refutation" of the additive or synergistic risk hypothesis – just as it cannot be indifferent whether, according to "the" project, the ecological and agricultural policy opportunities of the HR strategy are confirmed or "refuted."

Of course, it would be unsatisfactory if the outcome of controversies that were conducted in a discursive manner was nothing other than the positions announced before the proceedings. However, whether the observation of developments in the argumentation is accepted by the participants and whether it even allows further conclusions to be drawn cannot be decided by the observers alone. If their interpretations are not shared, they must be accused of exerting "consensus pressure." This approach appears to be covered neither by the course of the proceedings nor by the organizers' excellent position in terms of discourse theory. Reservations must apply here all the more because the organizers played a privileged role, especially in practice: "Although the WZB working group had no formal mandate to steer the TA process, it did have de facto influence" (van den Daele 1994, p. 123).

Instead of following their own insight that no one in the proceedings has the position of a neutral judge, and accordingly leaving the assessment of the results of the proceedings to a subsequent public discourse, the organizers nevertheless claimed to represent their reconstructions and conclusions as exclusively "cognitive assessments" of what was "the case" (van den Daele 1994, p. 135). The burden of justifying the contradiction was then placed on the participants. Apparently, it

is not reflected that the observers of the proceedings – in their own cause, so to speak – are just as little entitled to judge whether the objection is argumentatively appropriate to the "increasing pressure of justification."

In this respect, it seems that the consensus hypothesis based on "factual rationality" has taken on a normative function. Much less has been done to prove that "factual rationality" is actually capable of what was initially assumed: namely to pull itself out of the "swamp" of political controversies and epistemic discourses by its own bootstraps.

The normativization of the consensus-building function of the procedure is supported not least by the disappointment expressed that "the hard-won channels of participation may have been blocked again." It is also time to ask whether valuable resources for political mobilization are not being tied up in a dispute that is being lost internationally and in which the arguments of the critics are becoming weaker and weaker (van den Daele 1994). This probably reflects less the current state of a discourse than the state of a development characterized by competition for innovation. Whether the arguments on hypothetical risks have become "weaker and weaker" is something that no one is currently able to say conclusively for both fundamental and empirical reasons (on the inadequate quality of the accompanying research on the release of HR plants, see Kareiva 1993).

Thus, it seems obvious to me that the organizers – with their political orientation toward "rationalizing" decisions which have already been made on internationally unstoppable developments, with their thematic orientation toward approval-relevant questions of risk assessment, and with their sociological fixation on the consensus-building potential of "factually rational" discourses – practiced a strategic TA concept that in this case could serve less the cognitive preparation of political-administrative decisions than the attempt to generate acceptance. It was precisely this attempt that ended in disappointment.

Conversely, this does not mean that the environmental groups "won." Gill had already stated during the kick-off conference in Loccum in 1991 that the HR project, which was under consensus pressure, could ultimately only end with a political defeat of organized criticism of genetic engineering. The actual course of events now resembles his variant 3a: In line with Gill's description, the fundamental positions of industry and the research bureaucracy prevailed. As a commentary on the critics' withdrawal from the process, it was then to be expected that they "had just realized" that they "had no arguments on the basis of rationality" (Gill 1991, p. 19). Such a potential for sanctions was assumed by the

organizers with reference to procedural constraints and was practiced after the environmental associations withdrew (cf. van den Daele 1994).

In Gill's anticipatory calculation, the premise that industry and the authorities have completely different power-political resources than the environmental associations is certainly correct. While the former held the decision-making authority in their hands, the critics relied exclusively on their legitimacy and credibility vis-à-vis the organized grassroots and the public. Accordingly, both compromise-oriented "haggling" and the confirmation of the other side under the influence of those procedural constraints could only lead to a weakening of legitimizing resources. At best, variant 1 ("the critics get their way") would not be such a bad outcome, but would "change little" in terms of the practical decisions on the release of HR plants (Gill 1991).

In fact, the environmental groups were unable to assert themselves either with regard to decisions or with regard to the conception of the HR project. Although Gill had already openly stated during the kick-off conference in 1991 that the environmental groups themselves apparently no longer considered a "research moratorium" possible (ibid, p. 19), the environmental groups' statement of withdrawal criticized, among other things, that

> [...] the release of HR plants in Germany was started without regard to the still outstanding results and Ciba-Geigy withdrew its initial statement that it did not want to participate in the HR strategy (AbL et al. 1993, p. 13).

And although the demand for a problem-related examination of alternatives (Gill 1991, p. 20f.) had already been largely rejected in 1991, the environmental groups still made this point a key argument in their exit declaration in 1993 (AbL et al. 1993, p. 12).

The other points in the exit declaration (one-sided focus on "factual rationality," imbalance of resources) also point to the dilemmas of a democratic political TA perspective.

I would like to briefly outline these dilemmas on three levels:

- at the level of political-strategic calculations,
- at the level of the concept of "rationality,"
- at the level of practical procedural implications.

3.4 All-round "willingness to learn" or social democratization and a "round table"?

On the part of the organizers of the HR project, ambiguity could be identified between genetic engineering dissent in need of social clarification and a need for

(subsequent) decision rationalization (Sec. 3.1). On the part of the environmental groups critical of genetic engineering, this corresponds to the ambiguity between the search for effective decision-making instruments to prevent genetic engineering and a willingness to participate in discursive learning processes (cf. Gill 1993b).

Behind this lies a fundamental strategic dilemma in the criticism of genetic engineering. In view of the adoption of the GenTG and the increasing international use of genetic engineering, the practical question arose as to whether the general rejection of genetic engineering could still be sensibly maintained or whether it was necessary to specify the criticism in the various areas of use. Answers to this question lead to a systematic and a practical dilemma. Systematically, the discussion of specific areas of application ends in considerations in which the predominance of a social benefit cannot be ruled out in individual cases – for example, in the area of medical use. In practical terms, the diversification of criticism can lead to a fragmentation of forces and also no longer provide the public with a uniform picture (cf. Göttinger AK 1991).

Despite these risks of at least tactical differentiation of contexts of use, genetic engineering critics find it difficult to avoid such differentiation. On the one hand, this differentiation of genetic engineering assessment is already present in the public (cf. Gloede et al. 1993). Secondly, the criticism itself is by no means limited to safety concerns, but is centrally based on weighing up hypothetical risks and dubious benefits.

This dilemmatic situation meant that participation in the HR project was associated with ambivalent expectations. On the one hand, it was indeed expected to be able to provide exemplary proof of the irresponsibility or undesirability of this line of technology in order to influence the particularly critically assessed release plans, despite the decisions that had been made. This expectation is associated with talk of "participatory TA as a method of democratic technology design" (Kiper 1993b). The keyword "round table" (cf. Ökologische Briefe 1991; van den Daele 1994), suggestively thrown into the arena by the organizers, reinforced such expectations.

On the other hand, participation in the HR project was perceived as an opportunity to cognitively review and, if necessary, substantiate one's own assumptions and reservations about HR technology – for example, through a wealth of expert opinions on questions that would otherwise hardly have been dealt with in this form. In particular, the scientific ambition of the counter-experts was seen by Gill as a motive "to learn something new rather than to state the fundamentals" (Gill 1991, p. 19). The later questioning of the environmental groups also reveals

such an interest: information gain, interest in a discursive TA concept with the possibility of exerting discursive (!) influence on the other participants (Gill 1993b, p. 28).

However, the ambiguity outlined here consistently appears – particularly in the case of the representative of the environmental groups on the coordination committee of the HR project – as an expectation without contradiction. Apart from a certain overestimation of one's own abilities, which as late as 1993 was still taking credit for the actual implementation of a moratorium on releases ("initially"!) (Kiper 1993a, p. 311), the *tension between discourse and decision* is systematically and practically overplayed. This goes hand-in-hand with a further lack of clarity regarding the mode of "influence" of environmental protection groups on shaping technology and the future.

As far as influencing the formation of public opinion on genetic engineering is meant (ibid., p. 310), there is agreement with a discursive TA concept. In addition, however, two further forms of influence are suggested, which are neither adequately distinguished from the former nor from each other. The form labeled as a "round table" would probably be understood as *mediation* (see also Ökologische Briefe 1991, p. 15). Mediations are informal forms of participation of social actors in concrete decision-making processes. The extension of participation to include actors who are not formally authorized to make decisions is due to their conflict capacity (e.g., blockade power; cf. also van den Daele 1991, p. 32ff.). Democratic participation, however justified, should be strictly distinguished from this form of influence. However, Gill had correctly stated during the kick-off conference in Loccum that neither a power-political decision-making situation nor democratic participation was associated with the HR project. "It would by no means be democratically legitimate if we wanted to decide on such fundamental issues [...] in a small circle" (Gill 1991, p. 19f.).

However, neither discourse nor mediation, let alone democracy, are compatible with those expectations of the HR project that were aimed directly at enforcing the true and the good in a normative manner. The fact that it was Gill in particular who made himself the spokesperson for such orientations reveals the second dimension of the political-strategic ambivalence on the part of the environmental groups. In a nutshell, the normativist expectation can be formulated as follows:

(1) Meaningful TA only has to ask the right questions, give the right answers, and then consistently translate these into political decisions, and
(2) genetic engineering critics are already in possession of the right questions and the right answers – but do not have access to a decision.

The fundamental rejection of genetic engineering is as "trivial as it is true" (Gill 1991, p. 19) – all the more so as "empirical proof of our warnings [...] should not even be attempted" (ibid., p. 20). With a view to the fundamentals, any discursive TA becomes superfluous here. In retrospect, Kiper claims that the HR project confirmed the critics' assumptions and thus the "intuitive superiority of political discourse" (Kiper 1993a, p. 311). The background to such a view is probably the self-perception of environmental groups as keepers of the common good, who are opposed by industry, authorities, and established scientists as representatives of particular interests (Gill 1993b, p. 42; cf. also p. 3). In combination with a critique of the "superficiality of the concept of scientific rationality," these are the normativist premises of a claim to implement the true and just standpoint.

Despite criticism of the pressure for consensus from the organizers of the HR project, a consensus postulate is thus paradoxically placed *before* the implementation of the discourse, which is equivalent to the former.

This is not compatible with mediation procedures for the simple reason that such procedures are necessarily geared toward practical compromises that are limited in scope (see also Gill 1991). And such a consensus postulate could not be compatible with democratic decision-making, even if it had actually been confirmed in the course of the discourse. In concrete terms, a decision between the alternatives of "organic farming" and "pesticide strategy" could no longer be legitimized.

Under the impression of the discussions about the HR project, Gill has since modified his position. Today, he sees the call for TA to be more strongly related to decision-making or a legally enshrined obligation to consider as problematic. Such directly decision-related TA processes could hardly free themselves from the real existing boundary conditions and power relations. In addition, openness and mutual willingness to learn in order to develop creative technology policy options would only be possible if the TA processes were relieved of immediate decision-making pressure (Gill 1993a, p. 39). If one also assumes that TA discourses must not be subject to the expectation or even the compulsion of consensus, then the loss of legitimacy of environmental groups through "integration" in such procedures, which Gill apparently still fears, appears to be considerably mitigated (cf. Gill 1991, 1993a, p. 39ff.). Openness and willingness to learn on the part of *all* participants cannot be achieved without the risk of delegitimizing previous positions. Whether and to what extent this has repercussions in the power-political dimension will be the subject of political-strategic considerations on all sides. As there can be no meaningful obligation to participate in such discourses, it seems

unavoidable that the intended purposes, the effort involved, and the possible returns will continue to be weighed in the future.

3.5 Scientific discourse or rationality of the "lifeworld"?

One facet of the ambivalences outlined above, which is not reflected in the political and strategic aspects, should be mentioned briefly.

Basic normativist convictions imply a belief in the superiority of common sense. The "intuitive superiority of political discourse" (Kiper 1993a) over a restricted technical-scientific factual rationality is not only claimed with regard to *normative* aspects of "social rationality" and justice. It should also extend to the correctness of intuitions on social, political, ecological, and economic issues, the scientific assessment of which ultimately only provides confirmation. However, the criticism of an empirical-analytical conception of "factual rationality" conceals two things:

- The expansion of the scientific concept of rationality to include normative preliminary decisions and conceptualizations in no way eliminates the difference between science and its social environment, between scientific argumentation in discursive TA processes and "lifeworld" or political discourse in the public sphere.
- The limited nature of technical and scientific expertise in the narrower sense with regard to social issues does not make it superfluous.

In this respect, van den Daele is initially right:

> If science were essentially nothing but politics, it would be worthless as a means of political criticism. Then one could (and should) vote right away (van den Daele 1994, p. 142).

However, as little as it can be concluded from this that science determines "what is the case" in a value-free manner, the corrective function of the "factual reference" can also hardly be disputed by critical scientists. Critics of genetic engineering who normativistically fail to recognize this aspect of critical expertise thus practically deny its decisive role in the development of all major technology controversies. The subsumption of institutions such as the Öko-Institut under the heading of "environmental groups" would then be consistent (Gill 1993a). However, it should be noted that this subsumption follows the discursive classification normally used by the criticized technology advocates.

The unease felt by many supporters of a lifeworld rationality about the discrepancy between science and politics or between knowledge and will is prob-

ably a social reflection of problems that are perceived as increasingly complex and their fragmented scientific treatment. In this respect, the members of social movements probably resemble the representatives of the political system more than they think possible. However, functional and disciplinary differentiation in dealing with social problems seems almost impossible to ignore. The question is therefore rather how to deal practically with the plurality of social interests and academic dissent.

If, for example, the biological discourse on the risks of releasing genetically modified crops were to end in an argumentative "stalemate" between the additive and the synergistic concepts of risk assessment, as an expert from the Öko-Institut believes (Fankfurter Rundschau, 19 June 1993), this could not only express the undecidability of the epistemic discourse between molecular biology and ecology (cf. Schomberg 1992). Above all, the question would necessarily follow as to what practical research and regulatory consequences should be drawn from this politically and socially (cf. Gloede et al. 1993). One such consequence would be the required reversal of the burden of proof – but this demand can no longer be justified "scientifically."

A completely different problem, which is also familiar to the analysis of scientific policy advice, is the unavoidable difficulty of translating scientific analyses or even the results of scientifically inconclusive discourses into a language that is understandable in everyday and political terms (Paschen et al. 1991). In a strategic and probably also in a discursive TA concept, the translation process would have to take place in the phases of problem definition and interpretation of results that precede and follow the scientific processing phase. It is possible that the HR project also exhibited deficits in this comparatively trivial dimension and/or was accompanied by excessive demands on the "laypersons" involved. At any rate, this is indicated by the survey of the environmental groups (Gill 1993b, p. 35). This problem now draws attention to further procedural dilemmas.

3.6 Resource asymmetry in TA discourses or excessive demands on interested citizens and associations?

At first glance, it seems contradictory, particularly in terms of procedural practice, that the representatives of the environmental groups on the one hand demanded a "problem-induced" TA concept in the sense of an examination of alternatives on the basis of scenarios, but on the other complained about an almost unmanageable "flood of information" (Kiper 1993a; Gill 1993a) and a procedure that took too long. Even if one assumes that the complaint about the flood of information

is related to an inadequate preliminary clarification of the problem definition and considers that the complaint about the excessively long duration is to be understood in terms of the desired relevance of the results for decision-making (cf. Gill 1993b), the procedural dilemma remains. The more complex the initial problem is perceived to be and the more its implementation in discursive discussion is considered necessary, the more time-consuming the TA procedure must inevitably become in factual, temporal, and social terms. And even if relief from political decision-making pressure is guaranteed by discourse orientation (cf. Gill 1993a, p. 39), the problem of equal opportunities and equal resources, as discussed by the environmental groups, still arises (AbL et al. 1993). References to the approximately equal distribution of financial resources between supporters and opponents of HR technology (van den Daele 1994, p. 122) are likely to overlook this problem somewhat. Formal equality under conditions of social inequality confirms the latter rather than eliminating it.

On the other hand, the underlying inequality appears to be only partially compensable and only to a very limited extent within the framework of a single TA procedure. It is virtually impossible to achieve a balance between organizations structured according to the division of labor and equipped with considerable resources (large industrial companies, state administration), and functionally less differentiated, far less well-equipped environmental organizations (cf. Gill 1993b). For the latter, the commitment of their resources to TA procedures is almost inevitably at the expense of other tasks; the division of labor between participation in TA discourses or other dialogue offerings and public relations work can be considered *between* rather than within associations (Gill 1993a, p. 40). Comprehensive financial compensation (Gill 1993b) can only remedy this imbalance to a limited extent and also raises the question of the potentially problematic political consequences of professionalization promoted in this way. On the other hand, professionalization is also to some extent unavoidable for the grassroots and public-oriented environmental movement. The fact that the structural promotion of critical expertise is therefore a prerequisite for participation in TA discourses beyond the HR project (cf. Gloede 1994) is hardly controversial. Even parliamentary TA processes of a more strategic nature can hardly fulfill their function without recourse to a plurality of scientific institutes and concepts.

4. Outlook

In summary, I would like to clarify once again the possibility of mediation with regard to the expectations of the TA discourses outlined above, and at the same time ask about the conditions for their realization.

Discursive TA processes are a necessary but not sufficient condition for democratic technology governance in society, especially when the contingency and future orientation of decisions are at the forefront. At best, they are initiated when problems requiring a decision are accompanied by pronounced public dissent.

Such TA processes should attempt to compare *the disputed development and action options in a problem-oriented manner.* They cannot be carried out without preconditions, but must be open-ended. There can be no obligation to reach a consensus.

Their relationship to social and political decisions is communicated via broad public discourse and social conflicts. The *question of a democratization of technology policy* or social technology development can be the subject of such TA and public discussion, but does not coincide with them.

Participation in discursive TA cannot be justified in terms of democratic policy, but only on the basis of the tasks and conditions of discursive processes. Among other things, this means that the participants in discursive TA processes do not have to represent social opinions and interests *quantitatively*, but *qualitatively* or *argumentatively*.

This participation should take place at all three stages of the TA process:

- at the problem definition stage (bounding or scoping);
- at the problem processing stage (parallel expert opinions; controversial scientific discourse);
- at the stage of discussing and using the results (publicity and publication requirement).

There are basically two ways of organizing this process:

- through the expansion of a "*TA network*," i.e., through the pluralistic institutionalization of TA capacities among various social and political actors, who thus participate in public discourse with their own scientific and deliberative capacity (cf. Catenhusen 1988);
- by setting up one or more *central TA institutions*, or by initiating such projects in which plural interests and arguments are brought together in TA processes from the outset. *One* option for realizing this perspective is the

"foundation model" proposed by the Green Party in the Enquete Commission on Technology Assessment (Deutscher Bundestag 1989).

These perspectives are not necessarily mutually exclusive. In any case, in both cases the problem of formal and material equality of opportunity would have to be solved with regard to the consideration of those social arguments and interests that tend to be marginalized by the institutionalized mode of taking interests into account. No patent remedies for this have yet been presented. Catenhusen, for example, calls for state support for interests that are less capable of organization and conflict, as well as for "alternative" expertise (e.g., eco-institutes). The limits of this proposal are obvious. On the one hand, such state funding presupposes to a certain extent the ability to articulate the interests that it seeks to create. And on the other hand, the state funding bodies themselves would have to jump over the selective shadow they cast over the addressees to be funded. However, other proposals pose similar problems.

In addition to participation in – rather rare – discursive TA processes, there will continue to be functionally justified participation in strategic TA, which varies from case to case and depends on its possible contribution to the internal rationalization of the respective client. Here too, there is a latent contradiction between TA's proximity to the public and its proximity to decision-making. In my opinion, this can also be shown by comparing European forms of institutionalization of TA (cf. Gloede 1994).

On the other hand, in the case of highly politicized conflicts and public criticism with the power to impose sanctions (example: nuclear energy), the organization of a TA process itself can take on the character of a political negotiation. Participatory TA then takes on a *direct* mediative or democratic function – even if only as far as the decision-making powers of politics vis-à-vis society extend.

Such directly political functions can generate neither strategic nor discursive TA on their own – they are and remain dependent on resonance in the public sphere, both as a prerequisite and as a consequence.

Literature

Arbeitsgemeinschaft bäuerliche Landwirtschaft et al. (1993): Erklärung der Umweltgruppen zur Abschlußkonferenz des HR-Projektes. In: Ökologische Briefe 26 (5), pp. 12–13.

Bechmann, Gotthard; Gloede, Fritz (1986): Sozialverträglichkeit – eine neue Strategie der Verwissenschaftlichung von Politik. In: Jungermann, Helmut; Pfaffenberger, Wolfgang; Schäfer, Günther (eds.): Die Analyse der Sozialverträglichkeit für Technologiepolitik. Perspektiven und Interpretationen. München: High-Tech-Verlag, pp. 36–51.

Böhret, Carl; Franz, Peter (1985): Die Technikfolgenabschätzung als Instrument der politischen Steuerung des technischen Wandels? Speyerer Arbeitshefte Nr. 60. Speyer.

Bora, Alfons (1993): Gesellschaftliche Integration durch Verfahren – Zur Funktion von Verfahrensgerechtigkeit in der Technikfolgenabschätzung und-bewertung. In: Zeitschrift für Rechtssoziologie 14 (1), pp. 55–79.

Bora, Alfons; Döbert, Rainer (1993): Konkurrierende Rationalitäten: Politischer und technisch-wissenschaftlicher Diskurs im Rahmen einer Technikfolgenabschätzung von genetisch erzeugter Herbizidresistenz in Kulturpflanzen. In: Soziale Welt 44 (1), pp. 75–97.

Catenhusen, Wolf-Michael (1988): Technikfolgenabschätzung beim Bundestag – Diskussion ohne Ende. In: Jahrbuch Arbeit und Technik in Nordrhein-Westfalen, pp. 61–69.

Deutscher Bundestag (1989): Bericht und Empfehlungen der Enquete-Kommission "Gestaltung der technischen Entwicklung; Technikfolgen-Abschätzung und -Bewertung" Zur Notwendigkeit und Ausgestaltung einer ständigen Beratungskapazität für Technikfolgen-Abschätzung und -Bewertung beim Deutschen Bundestag. BT-Drucksache 11/4606. Bonn: Deutscher Bundestag.

Döbert, Rainer (1992): Konsensustheorie als deutsche Ideologie. In: Giegel, Hans-Joachim (ed.): Kommunikation und Konsens in modernen Gesellschaften. Frankfurt am Main: Suhrkamp, pp. 276–309.

Enquete-Kommission des Deutschen Bundestages; Catenhusen, Wolf-Michael; Neumeister, Hanna (eds.) (1987): Chancen und Risiken der Gentechnologie. Dokumentation des Berichts an den Deutschen Bundestag. Frankfurt am Main, New York: Campus.

Fiorino, Daniel J. (1990): Citizen Participation and Environmental Risk: A Survey of Institutional Mechanisms. In: Science, Technology, & Human Values, 15 (2), pp. 226–243.

Giegel, Hans-Joachim (1992): Diskursive Verständigung und systemische Selbststeuerung. In: Giegel, Hans-Joachim (ed.): Kommunikation und Konsens in modernen Gesellschaften. Frankfurt am Main: Suhrkamp, pp. 59–112.

Gill, Bernhard (1991): Technikfolgenabschätzung – Modernisierung der Beschwichtigungsrhetorik. In: Gen-Ethischer Informationsdienst 65/66, pp. 11–21.

Gill, Bernhard (1993a): Partizipative TA aus der Sicht von Umweltgruppen – Probleme, Ressourcen, Perspektiven. Berlin.

Gill, Bernhard (1993b): Partizipative Technikfolgenabschätzung: Wie man Technology Assessment umwelt- und sozialverträglich gestalten kann. In: Wechselwirkung 15 (63), pp. 36–40. https://doi.org/10.5282/UBM/EPUB.13892

Gloede, Fritz (1987): Neuartige Hilfsmittel zur Stärkung der Innovationskraft: Dauerbeobachtung, Folgenabschätzung, Frühwarnung. In: Böhret, Carl; Klages, Helmut; Reinermann, Heinrich; Siedentopf, Heinrich (eds.): Herausforderungen an die Innovationskraft der Verwaltung. Opladen: Westdeutscher Verlag, pp. 157–168.

Gloede, Fritz (1992): Rationalisierung oder reflexive Verwissenschaftlichung? Zur Debatte um die Funktionen von Technikfolgen-Abschätzung für Technikpolitik. In: Petermann, Thomas (ed.): Technikfolgen-Abschätzung als Technikforschung und Politikberatung. Frankfurt am Main, New York: Campus, pp. 299–328.

Gloede, Fritz (1994): Einrichtungen und Arbeitsweisen von TA in den Industrieländern – insbesondere in der Bundesrepublik Deutschland. In: Fenner, Brigitte (ed.): Technikfolgenabschätzung heute – Akzeptanzsteuerung oder Technikgestaltung? Standortbestimmung GRÜNER Forschungs- und Technologiepolitik. Marburg: BdWi-Verlag, pp. 27–48.

Gloede, Fritz; Bechmann, Gotthard; Hennen, Leonhard; Schmitt, Joachim J. (1993): TA-Projekt "Biologische Sicherheit bei der Nutzung der Gentechnik". Endbericht. Berlin: TAB.

Göttinger Arbeitskreis gegen Gentechnologie (1991): Die Kritik an der Kritik – Ja, nein, vielleicht – Die Uneinigkeiten der Gentechnik-KritikerInnen. In: Gen-Ethischer Informationsdienst 63, pp. 15–18.

Guggenberger, Bernd; Offe, Claus (1984): An den Grenzen der Mehrheitsdemokratie: Politik und Soziologie der Mehrheitsregel. Opladen: Westdeutscher Verlag.

Habermas, Jürgen (1964): Verwissenschaftlichte Politik und öffentliche Meinung. In: Humanität und politische Verantwortung. Festschrift für Hans Barth. Erlenbach (ZH): Rentsch, pp. 54–73.

Jochem, Eberhard (1988): Technikfolgen-Abschätzung am Beispiel der Solarenergienutzung. Frankfurt am Main: Lang.

Kareiva, Peter (1993): Transgenic plants on trial. In: Nature 363 (6430), pp. 580–581. https://doi.org/10.1038/363580a0

Kiper, Manuel (1993a): Partizipative Technikfolgenabschätzung. Chance für Einflußnahme von Umweltgruppen auf die Zukunftsgestaltung. In: Natur und Landschaft 68, pp. 309–312.

Kiper, Manuel (1993b): Partizipative Technikfolgenabschätzung als Methode demokratischer Technikgestaltung. In: Wechselwirkung 61, pp. 43–47.

Lohmeyer, Jürgen (1984): Technology Assessment: Anspruch, Möglichkeiten und Grenzen. Untersuchungen zum Problemkreis der Technikfolgen-Abschätzung unter besonderer Berücksichtigung des sozialwissenschaftlichen Beitrages. Bonn: Rheinische Friedrich-Wilhelms-Universität.

Luhmann, Niklas (1984): Soziale Systeme. Grundriß einer allgemeinen Theorie. Frankfurt am Main: Suhrkamp.

Miller, Max (1992): Rationaler Dissens. Zur gesellschaftlichen Funktion sozialer Konflikte. In: Giegel, Hans-Joachim (ed.): Kommunikation und Konsens in modernen Gesellschaften. Frankfurt am Main: Suhrkamp, pp. 31–58.

Naschold, Frieder (1987): Technologiekontrolle durch Technologiefolgeabschätzung? Entwicklungen, Kontroversen, Perspektiven der Technologiefolgeabschätzung und -bewertung. Köln: Bund-Verlag.

OECD Nuclear Energy Agency (1993): Public Participation in Nuclear Decision-Making: Proceedings of an International Workshop, Paris, 4–6 March 1992. Paris: Organisation for Economic Co-operation and Development.

Ökologische Briefe (1991): Herbizidresistenz: "Runder Tisch" zur Gentechnik. In: Ökologische Briefe 22, pp. 13–15.

Paschen, Herbert; Bechmann, Gotthard; Coenen, Reinhard; Franz, Peter; Petermann, Thomas; Schevitz, Jeffrey; Wingert, Bernd. (1992): Zur Umsetzungsproblematik bei der Technikfolgen-Abschätzung. In: Petermann, Thomas (ed.): Technikfolgen-Abschätzung als Technikforschung und Politikberatung. Frankfurt am Main, New York: Campus, pp. 151–184.

Rammstedt, Otthein (1970): Partizipation und Demokratie. In: Zeitschrift für Politik 17 (4), pp. 343–357.

Rautenberg, Thomas (1989): Die Rolle der Industrie und ihrer Verbände in der Diskussion um die Institutionalisierung einer Einrichtung zur Abschätzung und Bewertung von Technikfolgen. In: WSI-Mitteilungen 42 (3), pp. 131–144.

Rip, Arie (1987): Gesellschaftliche Prozesse in der Technikbewertung. In: Getzinger, Günter; Papousek, Boris (eds.): Soziale Technik. Antworten auf die Technikkritik. Wien: Verlag des ÖGB, pp. 157–176.

Scharioth, Joachim (1983): Problems of Public Participation in Technology Assessment. In: Technologien auf dem Prüfstand – Die Rolle der Technikfolgenabschätzung im Entscheidungsprozeß. Köln: Umweltbundesamt, pp. 311–313.

Schevitz, Jeffrey S. (1992): Zur nicht wertneutralen Technikfolgenabschätzung in den USA. In: Wechselwirkung 54, pp. 46–48.

Schomberg, René von (1992): Argumentation im Kontext wissenschaftlicher Kontroversen. In: Apel, Karl-Otto; Kettner, Matthias (eds.): Zur Anwendung der Diskursethik in Politik, Recht und Wissenschaft. Frankfurt am Main: Suhrkamp, pp. 260–277.

Throgmorton, James A. (1991): The rhetorics of policy analysis. In: Policy Sciences 24 (2), pp. 153–179. https://doi.org/10.1007/BF00138058

Ueberhorst, Reinhard (1990): Der versäumte Verständigungsprozess zur Gentechnologie-Kontroverse. Ein Diskussionsbeitrag zur Vorgehensweise der Enquete-Kommission. In: Grosch, Klaus; Hampe, Peter; Schmidt, Joachim (eds.): Herstellung der Natur? Frankfurt am Main, New York: Campus, pp. 206–223.

van den Daele, Wolfgang (1988): Das argumentative Dilemma des Widerstands gegen die modernen Biotechniken. In: Markl, Peter (ed.): Neue Gentechnologie und Zellbiologie. Wien: Österreichische Staatsdruckerei, pp. 245–269.

van den Daele, Wolfgang (1990): Technikfolgenabschätzung im Bereich der Gentechnik. In: Technikfolgenabschätzung. Braunschweig: Industrielle Gemeinschaftsforschung (IGF), pp. 9–26.

van den Daele, Wolfgang (1991): Zum Forschungsprogramm der Abteilung "Normbildung und Umwelt." Berlin: Wissenschaftszentrum Berlin für Sozialforschung.

van den Daele, Wolfgang (1993): Sozialverträglichkeit und Umweltverträglichkeit. Inhaltliche Mindeststandards und Verfahren bei der Beurteilung neuer Technik. In: Politische Vierteljahresschrift 34 (2), pp. 219–248.

van den Daele, Wolfgang (1994): Das falsche Signal zur falschen Zeit. In: Politische Ökologie Spezial 12, p. 65.

van den Daele, Wolfgang (1994): Technikfolgenabschätzung als politisches Experiment. Diskursives Verfahren zur Technikfolgenabschätzung des Anbaus von Kulturpflanzen mit gentechnisch erzeugter Herbizidresistenz. In: Bechmann, Gotthar; Petermann, Thomas (eds.): Interdisziplinäre Technikforschung. Genese, Folgen, Diskurs. Frankfurt am Main, New York: Campus, pp. 111–147.

van den Daele, Wolfgang; Pühler, Alfred; Sukopp, Herbert (1990): Antrag für ein Kooperationsprojekt: Folgenabschätzung und Bewertung des Einsatzes herbizidresistent gemachter Kulturpflanzen in der Landwirtschaft. Organisation eines Statusberichts als Verfahren der Technikfolgenabschätzung und -bewertung. Berlin.