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Contesting Lay/Expert Boundaries: Participatory TA of Agbiotech in Europe

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Abstract

European decision-making on techno-scientific issues has encountered public suspicion and legitimacy problems. These difficulties have resulted from government policies promoting specific technologies and normative commitments as if they were objective imperatives, especially in the case of agbiotech. European public responses have been interpreted through various ‘deficit’ models; the policy problem has been variously diagnosed, for example, as inadequate public knowledge, or as inadequate public rationality, or as inadequate ‘risk’ communication, or as inadequate regulatory frameworks, or as inadequate institutional capacity to address public concerns.

From those diagnoses, participatory technology assessment (TA) of agbiotech has been sponsored by state bodies with diverse, overlapping, even contradictory aims. Sponsors and other advocates have sought to educate the public, to counter ‘extremist’ views, to gauge public attitudes, to guide institutional reforms, and/or to manage societal conflicts. Some participants sought to open up the normative basis of technological decisions vis à vis alternative futures, but such efforts were marginalised. Overall these exercises internalised assumptions about agbiotech as societal progress, while channelling deeper conflicts into regulatory issues. Despite aspirations to democratise technological choices, the exercises tended to biotechnologise democracy.

In designing and managing the TA exercises, boundaries were imposed – between biotechnological imperatives versus alternative options, between scientific versus policy issues, and between expert versus lay roles – thus closing down issues. Some participants challenged the boundaries, thus opening up issues for a broader lay expertise. By contesting lay/expert boundaries, participants performed different models of the public

To some extent, participatory TA exercises have helped to hold governments accountable for regulatory criteria, but not for innovation choices. Pervasive tensions have arisen between discussing a ‘common’ problem – how to make agbiotech safe or acceptable – versus containing conflicts around problem-definitions. These tensions can be analysed by linking critical theories of technology, deliberative democracy, performative interactions and neoliberal governance.

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1 Introduction

Public participation in technoscientific issues has recently gained mainstream support in Europe, in response to greater controversy around new technologies. In responding to or anticipating such conflict, state bodies have sponsored formal participatory events, which can be seen as technology assessment (TA) exercises. Some were called citizens' or consensus conferences, where small pre-selected groups deliberated together on expert claims. Other events have been called simply 'public debates', alongside autonomous, sporadic public debates that were happening anyway.

These initiatives have attracted various criticisms – e.g. that participants were not representative of the public, or that the government did not make a prior commitment to follow views expressed there, or that technical aspects were separated from other issues. Those criticisms may be descriptively accurate but imply particular benchmarks, even a simplistic model of direct democracy. Together they imply that participants truly representing the public could guide government decisions – as if the government had no agenda of its own, nor a wider accountability to representative democracy.

For some analysts of participatory TA, at issue is 'how to make those in charge accountable' and thus 'how to organise effective accountability' for government decisions (Hagendijk and Irwin, 2006: 56-57). Some have echoed concerns that participatory methods may 'subvert broader democratic political processes' or that they may not be 'fit for purpose', (Burgess and Chilvers, 2006). As a basis to evaluate various participatory methods, criteria for success include the following: the quality of deliberative processes, consensual proposals from the process, influence on policy, etc. (Frewer and Rowe, 2004). Although those concerns and criteria are valid, they imply that state-sponsored TA exercises could have a clear purpose in promoting technological democracy and citizenship. Why should this be the case?

As a case study for such analysis, this paper focuses on agricultural biotechnology, a sector which has faced extraordinary public protest in Europe. Agbiotech has attracted diverse forms of public participation, e.g. open mass meetings, protest, boycotts, mass-media stunts and sabotage. Through these means, an emerging citizenry has demanded government accountability for innovation choices. In each national context,

Democratic engagement with biotechnology was shaped and constrained by national approaches to representation, participation, and deliberation that selectively delimited who spoke for people and issues, how those issues were framed, and how far they were actively reflected upon in official processes of policymaking (Jasanoff, 2005a: 287).

Among the various responses, many state bodies across Europe have sponsored formal participatory exercises, beyond simply access to regulatory procedures. So agbiotech provides a rich, multi-country case study.

This paper discusses the following questions:

How and why did state bodies sponsor participatory TA of agbiotech?

What aims arose in designing, managing and using those exercises?

How did the process shape relations between expert and lay roles?

How did participants raise questions about agbiotech and government policy?

How did the overall process bear upon the accountability of representative democracy?

Overall this paper analyses the tensions involved and their implications for government accountability. Approximately the first half surveys analytical perspectives, especially STS literature which links technological choices, 'risk' controversy and deliberative democracy. The survey emphasises theoretical and normative disagreements about the appropriate roles for participatory exercises.

Approximately the second half analyses national cases of public participation in assessing agbiotech, with a more detailed account of the 2003 UK case. The five national cases have been chosen on several grounds: their high profile political importance and documentary sources for them. In particular, critical analyses have highlighted tensions and power relationships that might otherwise

be ignored by a putatively 'neutral' account. As much as possible here, critical analyses are juxtaposed with the organisers' own accounts, statements by participants and other relevant documents. Together these provide a basis to analyse conflicting agendas – of organisers, participants and perhaps analysts.

My account remains largely dependent upon those sources for empirical information. I attended only one part of two relevant events: the public conclusion of the 1994 UK conference; and one public meeting of the 2003 UK science review (Levidow, 2003). In addition I read original reports of the French event (OPECST 1998b), though not the German or Danish ones.

The available information sources should be adequate for answering the analytical questions posed above. More detailed information about the process would be needed for a comparative typology of cases (as done by Hansen, 2006). Likewise, more analysis of the national context would be needed to locate each exercise in a political culture and its legitimation strategy (Levidow and Carr, forthcoming); such aspects have been omitted to minimise the length.

2 Generating legitimacy problems

New technologies often become contentious because they embody or promote normative assumptions about the societal problems to be solved, and thus limit what would count as a solution. Such assumptions generated an EU legitimacy crisis over agbiotech in particular and thus drove a search for 'governance' solutions.

- Biotechnological determinism

Since the 1980s technological innovation has been driven increasingly by pressures for global economic competition. Public-sector institutes have been made more dependent upon profit motives and private finance, thus blurring the distinction between private and public interests. In European agri-food research, R&D priorities have shifted towards knowledge for profitable commodities and royalties on patents. This shift has undermined the capacity to serve the public good through innovation and independent expert advice (Levidow et al., 2002).

Such warnings came from leading members of EU-level scientific committees (James et al., 1999). When appointing scientific advisory committees, governments have encountered greater difficulty in recruiting members independent of private interests, in at least two senses. First, even if scientists are not employed by industry, their careers and institutes are often dependent upon industry contracts. Second, their individual standing depends upon gaining such contracts through competitive tenders, conducting prestigious research, publishing high-quality papers, etc. Consequently, few are willing to serve on advisory committees. Given these pressures, 'it will prove increasingly difficult to recruit top-flight scientists', and members tend 'to consider themselves operating in a consultancy mode', therefore requiring substantial remuneration (ibid: 66).

Moreover, EU innovation policies have invoked market-technological imperatives for specific technological trajectories. Since the early 1990s, the European Commission has promoted infotech and agbiotech as essential means to enhance efficiency and thus create wealth, even to ensure economic survival. In its 1993 White Paper on 'Growth, Competitiveness, Employment', the Commission characterised the entire agri-food industry as 'dependent' upon genetic modification techniques (CEC, 1993).

As objective imperatives, technological determinism was linked with inexorable globalisation (cf. Barben, 1998). This framework avoided accountability for its own normative choices and commitments. Under 'risk-based regulation', product safety according to 'sound science' would be the only criterion for approval decisions. More generally, 'technological progress' was equated with the common societal good (Levidow and Marris, 2001). With such language, a neoliberal policy foreclosed alternative problem-definitions.

That policy framework was undermined by various food scandals, especially BSE (bovine spongiform encephalopathy), better known as the mad cow crisis. Critics questioned the optimistic

assumptions which underlie agri-industrial efficiency, safety claims and ‘risk-based regulation’. Activists targeted agbiotech as an ominous symbol of ‘globalisation’, threats to democratic sovereignty and hazards of industrialised agriculture (Heller, 2002; Levidow, 2000; Murphy and Levidow, 2006). Public controversy raised the stakes for ‘science’ and generated suspicion towards expert claims.

- Governing which ‘common problems’?

As the EU crisis illustrates, neoliberal policies leave governments vulnerable to legitimacy problems. According to a neo-Gramscian analysis of ideological hegemony, ‘economic globalisation and political change have created a crisis of the old hegemonic structures and forms of political consent, which are now coming apart...’ (S.Gill, 1993: 32-33). Global governance ‘can be seen as a product of two phenomena: the pursuit of neoliberal forms of globalisation, and the resistance to such centralisation of power’ (Paterson et al., 2003: 149). Governance can mean citizen involvement which enhances the accountability of representative democracy, but the term can have contrary meanings, to be elaborated next.

In mainstream policy language, governance is often understood as co-operative means to deal with common problems. It denotes ‘a continuing process through which conflicting or diverse interests may be accommodated and co-operative action may be taken’ (CGG, 1995: 2). According to political scientists, governance involves social institutions ‘capable of resolving conflicts, facilitating cooperation, or, more generally, alleviating collective-action problems in a world of interdependent actors’ (Young, 1994: 15).

But which ‘common problems’? Policy issues involve contending ways to define societal problems. Tensions arise between resolving a problem, on the one hand, and containing conflicts around the problem-definition, on the other. ‘Process management’ addresses this tension through wider participation, sometimes called governance (Young, 1997).

Governance involves the premise ‘that a problem is “common”, in the sense that stakeholder advantage cannot be obtained – nor, often, defined – independently from collective reasoning’. Yet such advantages are often foreseen, as a basis for some stakeholders to pursue antagonistic agendas (Pellizoni, 2003). Rather than accept a dominant agenda, they promote uncommon problems, i.e. contending accounts of the common good.

According to critical perspectives, governance strategies help to contain or marginalise antagonistic agendas, while undermining representative democracy. Management and ‘governance’ presuppose pacified worlds in which common aims could be defined for the good of all (Pestre, 2004: 364).

As Moreau Défarges [2001] and others have suggested, the vocabulary of governance conveys the idea that the world of politics, as it was invented and has been practiced for more than two centuries, is *de facto* obsolete. Not only because it is based on an overly conflictual understanding of the social, but also because it relies too much on the State and the formal procedures of representative democracy.... (Pestre, 2007).

In that vein, governance aims at establishing common values for the management of a collective and ultimately reconciled future: ‘The only remaining questions are procedural and managerial in nature’ (ibid.).

According to another critic, governance strategies provide a ‘discursive de-politicisation’, effectively removing societal choices from the political agenda.

The democratic public is dislodged from its position as (in principle) the ultimate judge and arbiter in the realm of “governing”; with governance, it is at best one among many stakeholders – it [the public] merits no privileged position (Goven, 2006: 104).

In this strategic sense of governance, fundamental conflict can be displaced onto supposedly collective problems and solutions. Choices about societal futures can elude the formal accountability of representative democracy, even through participatory exercises.

This tension has been theorised as ‘two contrasting advocacy coalitions’. Neoliberal governance invokes ‘sound science’ for approving safe products, as a basis for consumer choices; it puts the

burden of dialogue on the private sector. By contrast, participative governance accommodates cultural diversity, social fairness, and more equitable power relations; it downplays the formal electoral process, in favour of civil society (Walls et al., 2005).

Such a contrast is misleading. Yes, public participation can downplay electoral politics and thus displace representative democracy – but only to make decisions less democratic. This displacement is integral to neoliberal governance. Neoliberal and participatory elements exist in tension within the same ‘governance’ process, not just as antagonistic coalitions, which provide the wider context for governance strategies.

3 Governing technology as a ‘risk’ issue

In the European Union, ‘governance’ has become a mainstream policy term since the late 1990s. This concept intersected with general debate about a ‘legitimation gap’ or ‘democratic deficit’. According to many critics, EU policymaking eclipsed or concealed the role of national governments, while favouring influence by industry. In response, the Commission’s White Paper on European Governance set out principles of ‘good governance’, e.g. more openness and wider participation throughout all stages of the policy process (CEC, 2001a).

This debate responded to a legitimacy crisis of risk regulation, featuring public scandals over food and medical safety. A widespread criticism was that politicians often used expert advice to avoid responsibility for decisions. The EC White Paper acknowledged this problem:

It is often unclear who is actually deciding – experts or those with political authority. At the same time, a better-informed public increasingly questions the content and independence of the expert advice that is given (CEC, 2001a: 19).

Consequently, special prominence was given to the problem of ‘Science and Governance’. As these discussions recognized, official expert advice was often challenged by ‘counter-experts’ and so could not straightforwardly legitimize policy decisions:

While being increasingly relied upon, however, expertise is also increasingly contested....

‘Traditional’ science is confronted with the ethical, environmental, health, economic and social implications of its technological applications. Scientific expertise must therefore interact and at times conflict with other types of expertise... (Liberatore, 2001: 6).

As a way forward, there were proposals to democratise expertise – as in the title of the above report.

In a similar way, legitimacy problems have been attributed to governmental over-dependence upon expertise. ‘At stake here is the Enlightenment project, where objective science and representative democracy are combined to provide a new legitimation of the State’, argue De Marchi and Ravetz (1999: 754). That project was undermined by several risk crises, in their view. Even speculative hazards could undermine public trust in risk regulation. ‘Here it is the uncertainties which dominate, and which require the reference to explicit values’ (ibid: 755). From that problem-diagnosis, they advocate wider public participation as an ‘extended peer review’ of official expert judgements. However, NGO involvement requires a somewhat ‘self-contradictory balance between their functions as critics and as stakeholders’ (ibid: 756).

Specific forms of public involvement relate to diagnoses of policy problems. A legitimacy crisis has been widely attributed to deficiencies in public attitudes. In the mid-1990s the problem was initially diagnosed as problems of public irrationality or ignorance. A later diagnosis was ‘public distrust’, attributed to institutional deficits – e.g. of risk communication about technologies, or of transparency about regulatory criteria and procedures. With this shift in deficit models, later diagnoses and remedies supplemented earlier ones, rather than simply replace them (Levidow and Marris, 2001).

The need to gain or restore trust has served to justify various remedies – to educate the public, to make advisory expertise more independent, and even to make institutions more trustworthy. For the latter task, remedies have included greater transparency, broader expertise, consultation and even participation, sometimes called ‘governance’.

Such an incorporation process was foreseen in *Governing Molecules*, an early analysis of European conflict over agbiotech. As issue-framings became polarised in national debates, policymakers sought to maintain or gain hegemony ‘by re-absorbing discourses of polarity into a system of “legitimate differences” and by defining the locations where differences can be articulated’. In this way, they might absorb critics’ demands through broader expertise. The boundary between experts and non-experts became more permeable and negotiable. Controversial socio-economic issues were transformed into problems of ecological risk assessment; the former could not be legitimately debated, as industry was still embraced as a location of progress (Gottweis, 1998: 319-21).

Within efforts at wider participation, different deficit models remain in competition. In parallel with ‘governance’ remedies, expert-regulatory institutions still regard public attitudes as the problem and an obstacle to technology progress. New practices encompass old assumptions. Participation is often still designed to address ‘risk’ perceptions; it aims to achieve trust and social consensus through engagement, while demonstrating objectivity through openness and transparency (Irwin, 2006).

Such processes tend to reify both ‘risk’ and ‘citizens’. In participatory exercises, ‘risk’ is reified twice: by defining the universal public meaning of technological controversy as ‘risk’ issues; and by selecting particular ‘risk’ definitions as natural, objective and universal. Citizens are modelled according to specific ‘risk’ issues and definitions, while excluding others. Some participatory processes frame issues and model citizens in such ways, which are not democratically accountable (Wynne, 2005).

Indeed, governments tend to communicate about technology through concepts of risk and safety. Various participatory procedures can be compared according to how they address those concepts (Hansen, 2006: 574). Yet the procedures may channel societal conflict into ‘risk’ language.

A recent report critically analysed efforts at public participation in risk issues. Such efforts ‘reflect a consistent and persistent under-emphasis of the ways in which risk assessment inevitably rests on normative commitments’. In so doing, they avoid questions about how risk assessment constructs society, especially in a policy context promoting ‘competitiveness of the European knowledge-economy’, and how different norms could guide a future Europe. As an alternative to risk governance, the authors propose a move to a more ‘upstream’ *innovation-governance* (EGSG, 2007: 30, 39).

4 Democratising technology – or managing conflict?

In the recent history of public participation in technological issues, diverse agendas have been at play. According to Lars Klüver (2006, cf. 1995), a long-time advocate at the Danish Board of Technology, public participation has recently become mainstreamed, along with changes in its policy role. Originally it was promoted as a vehicle for democratisation and citizen empowerment, so that people could challenge policy assumptions and influence decisions. Now public participation goes hand-in-hand with liberalism: politics is seen as a market of opinions, so citizens should be invited into the open market (cf. Popper, 1962).

Participation now becomes yet another governance tool among others, e.g. for adjusting, supplementing or enhancing the policy process. Aware that they often lack public confidence, policymakers seek methods of upstream conflict-management. These professional reasons have recently driven interest by mainstream institutions in public participation and will continue to do so, he argues (Klüver, 2006).

Upstream conflict-management restricts the role of participants. In the UK, for example, there have been various proposals for ‘upstream public engagement’ between the public and scientists at an early stage, as means to deliberate possible innovation choices and to make them more accountable (e.g. Wilsdon and Willis, 2004). By contrast to those ambitious aims, they warn:

[public engagement] is sometimes portrayed as a way of addressing the *impacts* of technology – be they health, social, environmental or ethical – rather than helping to shape the trajectory of

technological development. The hope is that engagement can be used to head off controversy... (Wilsdon et al., 2005: 33).

Indeed, conflict-avoidance or conflict-management may be built into the design of public engagement.

Such aims conflict with agendas to democratise technology, e.g. by enhancing the public accountability of innovation trajectories. To do so, participatory design should acknowledge that science and innovation are social, cultural and institutional activities.

As such, public engagement offers a way to be more accountable for the particular values and interests, which underpin both the governance of science and the general use of science in governance... Public engagement holds greatest value when it occurs 'upstream' – at the earliest stages in the process of research or science-informed policy making... In practice, the relationship between representative democracy and participatory methods becomes most clear and complementary, when engagement is approached as a means to 'open up' the range of possible decisions, rather than as a way to close this down. Choice among the options thereby identified then becomes a clearer matter of democratic accountability (Stirling, 2006: 5; cf. Stirling 2005).

Achievement of such accountability depends upon the aims, design and management of the process.

In some accounts, citizen deliberation provides a consensus-seeking process. This provides an advantage over pluralist interest-group bargaining, which abandons any sense of the common good or (by default) regards it simply as the outcome of a bargaining process. By contrast, broader deliberation of stances requires publicly defensible reasons, which are subjected to scrutiny and thus are drawn more from common interests than special ones or from manipulative language. In such an interactive process, lay participants may go beyond their prior assumptions or preferences. This practice serves 'the goal of reaching a consensual resolution about how policymakers should manage the issue'. Moreover, 'Deliberative democratic theory deconstructs the assumption of "given" preferences by looking for practices through which preferences are formed and how they might be changed in a consensual, democratic direction' (Hamlett, 2003: 120-121). This idealised, prescriptive account associates consensual policy advice with democracy. Such an association evades important questions: how consensus-seeking may restrict the range of 'common' problems, and how the process deals with divergent accounts or suppresses them.

As a more modest rationale for public engagement, it can be helpful for exploring sources of conflict: 'the main purpose of a public debate is not to eliminate the conflict, but possibly to clarify what [the] conflict is really about' (de Marchi, 2003). As a key source of conflict, expertise implicitly pre-defines societal problems in narrow ways. So a participatory entry point is to open up those normative definitions, which do not depend upon technical knowledge (Fischer, 2000: 185). At the same time, normative and empirical aspects readily become mixed, so the mixture warrants scrutiny (ibid: 19).

In technological controversies, moreover, 'technical' information is often disputed along several lines. There are contested boundaries between technical/social issues, expert/lay roles, etc. In participatory exercises, 'The organisers and facilitators take on the role of "translating" the often inaccessible technical data underlying a particular issue for the nonexpert participants, in effect constructing the issue and problem [that] the deliberators are to address' (Hamlett, 2003: 127). Thus the organisers' role can open up or close down the deliberation of expert judgements.

In technological controversies, counter-expertise has helped to demystify scientific expertise, but citizens still remain an audience. Lay people are left wondering which experts or counter-experts should be believed. As an entry point for a more democratic approach to technologies, expert procedures involve normative judgements, so these can be opened up to public scrutiny (Fischer, 1999: 297-98). 'Lay expertise' describes many cognitive capacities to evaluate expert claims and assumptions (e.g. Wakeford, 1998; Kerr et al., 1998), including efforts to influence what counts as credible knowledge claims (Epstein, 1995).

In technoscientific debates, however, distinctions are drawn between technical and non-technical aspects of an issue. By treating some aspects as technical, such language becomes a weapon in

power struggles (Hamlett, 2003: 129). Research could investigate these questions: 'On what occasions and for what purposes is the technical distinguished from the non-technical? To what extent does this distinction perform different communities...?', e.g. as expert versus lay actors (Grint and Woolgar, 1997: 67). Conversely, how do deliberative procedures perform such distinctions? And how do the performances impose or blur lay/expert boundaries?

These performative aspects depend upon the specific setting and staging of a participatory exercise. The setting may limit what can be said with influence on the process. Participants are thereby constructed in specific roles – e.g. as protestors or as collaborators – thus performing different roles in relation to expertise. Performative interactions produce understandings of the policy problem at hand (Hajer, 2005).

Considered together, the above perspectives may indicate practical tensions that arise in designing and managing participatory TA exercises. Indeed, participants may perform various meanings of technology, the public, democracy and their relationship. There may be considerable differences between normative objectives and actual roles – which depend on the participatory design, policy contexts and wider societal resonances (Joss, 2005a: 209). Although participation could influence policy frameworks, a particular exercise may instead reflect them (Sperling, 2007), thus reinforcing policy. Rather than evaluate participation according to an ideal model, each case should be seen within a strategy for how to represent agbiotech, the public and the relevant expertise. Those perspectives provide a critical basis to analyse particular cases, as in the rest of this paper.

5 Denmark 1987: sustainable agriculture?

The Danish consensus conference has been advocated as a 'counter-technocracy', as a means to challenge or deliberate expert claims. The lay panel has no vested interest different than the general public, and its report helps to promote technology assessment (TA) as a broad social process. It extends a tradition of people's enlightenment, whose principle is that 'a well-functioning democracy requires a well-educated and engaged population'. Successful participation is understood in those terms, e.g. 'We initiated a really good assessment process among the public' (Klüver, 1995: 41, 43). In the Danish consensus conference, then, 'interested citizens' personify a political culture in which technological decisions are held accountable to public debate, mediated by Parliament.

Denmark's debate on agricultural biotechnology was initiated in the mid-1980s by environmental NGOs. A series of 'debate booklets' were issued by NOAH, the Danish affiliate of FoE, proposing new legislation to regulate GMO releases. In response to public concerns, a Parliamentary 'green' majority imposed a statutory ban in the 1986 Gene Technology Act; GMO releases would not be permitted unless there was sufficient knowledge about the ecological consequences (Toft, 1996). With this wording, the government could be held accountable to demonstrate such knowledge for risk assessment; this burden of evidence meant a *de facto* ban for several years.

Parliament also mandated funds for an information campaign on biotechnology. Some funds were specially earmarked for NGOs, especially NOAH and some trade unions, in order to stimulate further debate on advantages and disadvantages of biotechnology. In these ways, environmental NGOs gained extra resources and political opportunities to frame the issues for further public debate. NOAH organized ten public conferences on the wider environmental consequences, on sustainable agriculture including organic agriculture, on food labelling, on animal welfare and ethics, on the Third World, on seed diversity (including patents), and on biological warfare. These debates were reported through a series of publications and statements from NOAH.¹

In that context the Danish Board of Technology held its first consensus conference in 1987 on 'Gene Technology in Industry and Agriculture', timed to coincide with Parliamentary debate on the issue (Hansen et al., 1992; Klüver, 1995: 44). In its report the lay panel took up risk issues as well as ethical ones (Teknologinævnet, 1987). Accepting a key recommendation, Parliament voted to exclude animals from the 1987-90 national R&D programme for gene technology. The conference eventually had more profound effects on the Danish regulatory regime through wider public debate.

¹ Much information here, supplied by Jesper Toft, is not available in English-language documents.

A further information campaign was coordinated by the Board of Technology and Danish Adult Education Association. During 1987-1990 they supported more than 500 local meetings all over the country in order to stimulate debate on human and non-human uses of biotechnology, including concerns about risk and ethics. Environmental NGOs were often invited to speak, as the most visible critical actors on the scene.

The government also funded a subsequent programme, organized by trade unions, to stimulate further debate on advantages and disadvantages of agbiotech. Their educational materials posed questions about sustainable agriculture: For example, would genetically modified crops alleviate or aggravate the existing problems of crop monocultures? (Elert, 1991: 12). Through that wider debate, the consensus conference indirectly influenced Parliament and thus regulatory policy.

In the EU-wide regulatory procedure, dominant member states implicitly took for granted eco-efficiency benefits of herbicide-tolerant crops, while disregarding the herbicide implications or assuming them to be benign (Levidow et al, 1996, 2000). By contrast to those EU-level assumptions, Danish regulators were held publicly accountable for assessing the broad implications of GM crops for agricultural strategy, herbicide usage and the environment. Such judgements were scrutinised by the Parliament's Environment Committee, often by drawing upon specific questions from NGOs. Under such domestic pressures, Danish representatives in turn proposed that risk assessments evaluate those implications at the EU level (Toft, 1996, 2000).

Thus citizen participation enhanced government accountability for regulatory criteria, going beyond optimistic assumptions about environmental benefits. GM crops were subjected to criteria of sustainable agriculture, which in turn were opened up to the lay expertise of agbiotech critics. Environmental NGOs found greater scope to influence regulatory procedures and expertise.

Agri-innovation choices became more contentious in the late 1990s, however; NGOs demanded alternatives to agbiotech and to intensive agricultural methods. In a 1999 consensus conference, the lay panel asserted the need for extra measures – not only for product safety, but also to prevent GM products 'becoming controlled by monopolistic companies', as well as measures to evaluate ethical aspects (Einsiedel, 2001). As the conference organisers emphasised, those proposals were expressing citizens' viewpoints, thus providing a basis for dialogue with decision-makers (Teknologinævnet, 1999). The panel's proposals challenged the assumptions and limits of the EU legislative framework. Yet public demands for accountability were being channelled into more stringent measures to regulate biophysical risks. This pervasive tension has parallels in later TA exercises.

6 Germany 1991-92: participation trap

Since the time that the German government promoted agbiotech in the 1980s, this policy provoked widespread protest – e.g., from the Green Party, environmentalist groups and local campaigns. Although critics gained high-profile attention in the mass media and civil society, their views remained marginal to official procedures, unlike German corporatist arrangements for labour issues. Opposition to agbiotech split civil society and the major political parties (Gill, 1996).

- TA exercise

German public controversy focused on herbicide-tolerant crops, given their potential for spreading that trait and for changing patterns of herbicide usage. To address such conflicts, the government sponsored a TA exercise on GM herbicide-resistant crops in the early 1990s. Funding came from the Ministry of Industry and Research, which was strongly promoting biotechnology. It was initiated and coordinated by the Berlin Wissenschaftszentrum (Science Centre) as an experiment in environmental conflict management. The 50-odd participants had quasi-expert roles; they included overt proponents and opponents of HR crops, as well as representatives of regulatory authorities, agricultural associations, consumer organisations, etc. From the start, conflict erupted over how to define the relevant scientific issues and the expertise needed to evaluate them.

A broad participation was needed to deliberate the arguments arising in the polarised public debate on agbiotech, according to the organisers. The TA was designed to evaluate those arguments for and against herbicide-resistance GM technology, especially its possible consequences – but not alternative options for weed control in agriculture. Thus the procedure was 'a technology-induced TA, not a problem-induced TA' (van den Daele, 1995: 74).

Environmental NGOs counterposed the latter approach. They wanted the TA to compare biotechnology products with other potential weed-control methods, as alternative solutions to agricultural problems. However, the NGOs' proposal was rejected by the organisers (B.Gill, 1993). Consequently, the narrow remit set difficult terms for participation by the broadly representative individuals from NGOs – indeed, terms for their expert status.

As the organisers acknowledged, 'The TA implicitly accepted the matter-of-course development of technology as the starting point', as well as possible risks as the main grounds for state restrictions: 'If critics fail to provide evidence of relevant risks, the technology cannot be banned.' So critics held the burden of evidence for any risks. Advocates held the burden to demonstrate benefits, though failure to do so would have no bearing upon regulatory decisions (van den Daele, 1995: 75). This framework marginalised alternative agronomic solutions, while reinforcing the dominant system: 'intensive farming as the reference system'. Within that framework, participants themselves defined their controversies as debates about empirical evidence, e.g. regarding the possibility of environmental damage – not about values and goals (ibid: 76, 77).

The organisers aimed to include and deliberate all viewpoints on the risk-benefit issues. By subjecting expert views to scrutiny, the TA could reach conclusions about empirical claims, rather than political or ethical ones. 'This procedure placed participants under massive pressure either to admit consensus or justify dissent', especially through detailed empirical evidence (ibid: 80).

From NGOs' standpoint, the technology-induced TA framework effectively favoured experts in specialized technical areas, e.g. gene flow and herbicide effects. In practice, the TA exercise set a lower burden of evidence for demonstrating benefits than for demonstrating risks, in a period before much empirical research had been done on risk scenarios. Consequently, the discussion emphasized environmental benefits, especially the prospects for farmers to use less harmful herbicides and/or lower quantities of them (B.Gill, 1993).

On the basis of the expert reports, the TA symbolically normalised any risks. According to agbiotech proponents, echoing the government's advisory body, any risks from GM herbicide-tolerant crops were similar to those from conventional crop plants and herbicide usage. 'In many areas it was argued that there was no need for political action because the identifiable problems could be dealt with in the established registration procedures.... if one agreed to the "normalisation" of the risks' (van den Daele, 1995: 82). In this way, the exercise undermined NGO claims about novel or unknown risks; once normalised, any risks would be manageable through regulatory procedures, even contemporary ones.

- Science court or parliament?

The technology-induced TA framework posed a dilemma for participation by agbiotech critics. Once inside such an exercise, 'They have to criticize a technology which promises to satisfy some needs which may even be produced by the technology itself...' (B.Gill, 1993: 74). That is, putative benefits satisfy 'needs' which are predefined by biotechnological solutions for intensive monoculture. Thus a technology-induced TA tends to accept and reproduce the social vision built into the technology.

Environmental NGOs and their associated research institutes faced a difficult choice: either play a quasi-expert role within that framework and thus help legitimise it, or else abandon that role and be treated as merely lay voices. After much conflict, they withdrew before the TA exercise could report its conclusions. They gave several reasons for withdrawal, e.g. that their voluntary participation was occupying too much time, especially the task of commenting on long expert reports (van den Daele, 1995: 81). According to an NGO expert, 'I had not imagined that you could destroy participation by

throwing paper on top of people' (cited in Charles, 2001: 107). By withdrawing from the TA, they could devote greater resources to public protest and preserve their credibility with NGO members and activists (B.Gill, 1993: 81-82).

After this withdrawal decision, they were criticized by the WZB coordinator:

One cannot present one's position in public as scientifically substantiated and then cast fundamental doubt on science as neutral... Participation in the procedure implies the readiness to submit oneself on the empirical issues to the judgement of science (van den Daele, 1995: 84; also 1994).

As the WZB coordinator told the story many years later, he had been sceptical of claims that herbicide-tolerant crops had special risks or special benefits, so he saw NGO arguments about risks as a proxy for political ones:

... the idea of special risks is not a good argument. We should turn to the issues of democracy and who's going to decide how society develops... Apparently it would have been difficult for them [NGOs] to declare explicitly that the conflict was not about risks, but about social goals and political reforms... (van den Daele, cited in Charles, 2001: 107).

However, that distinction was not so clearly drawn by the organisers beforehand; it became more explicit in later retelling the story. According to a social scientist who attended the TA exercise, some NGO participants saw it as analogous to a parliament which could evaluate agbiotech in terms of societal goals. However, van den Daele retrospectively portrayed it as a science court, whose remit the NGOs did not understand or accept; this portrayal offers a *post hoc* legitimation for the failure to integrate them (personal communication, B.Gill, 2006).

Moreover, the distinction between a science court and parliament is not so straightforward; neither is the distinction between risk assessment and socio-political goals. At issue was the range of questions to be answered by science, their normative assumptions, and the alternative technological options to be considered as comparators for agri-environmental assessments. Some questions from participants were pre-empted or marginalised by the TA exercise, especially by constructing particular boundaries between expert and lay voices.

Societal futures were reduced to scientific issues, readily assessable by experts in 'the state of the art'. Civil society representatives found themselves in a 'participation trap'; they could either participate within the government's risk-benefit framework for GM crops per se, or else be marginalised. Overall the exercise reinforced the government's policy framework and its public unaccountability. In a similar way, societal conflict over agri-innovation issues was channelled into risk assessment through regulatory procedures. Together these practices extended and reinforced the *Rechtstaat*, at least until government policy began to change in 2002.

7 UK 1994: risk-benefit framework

Before the UK had any significant public debate on agbiotech, a National Consensus Conference on Plant Biotechnology was held in 1994. Proposed by staff at London's Science Museum, it was funded by the Biotechnology and Biological Science Research Council (BBSRC). Initially reluctant to sponsor the event, the BBSRC was persuaded by the focus on GM crops as 'the least contentious' area of biotechnology, especially as compared to animal biotech. Yet civil servants criticised that focus because agbiotech was not being considered in policy debate at that time (Joss, 2005a: 211).

The exercise was coordinated by the Science Museum, whose staff implicitly diagnosed the problem as public misunderstanding or anxiety. The coordinators had previously obtained funds in the name of diagnosing and overcoming public unease about biotechnology. At the beginning and end of the Consensus Conference, the funders made clear their aim to enhance 'public understanding' of biotechnology and thus support for it. Underlying the exercise was a presumed cognitive deficit of the public.

The Consensus Conference centred upon a lay panel of relative newcomers to the biotechnology debate; they would question and learn from designated experts – whose selection was contested within the Steering Committee. Two members attempted to exclude representatives of 'extreme'

anti-biotech groups from expert status – and thus from a list prepared by the organisers – though this effort did not prevail (Joss, 2005b: 211). The organizers portrayed themselves as neutrally mediating between experts and the public. However, the exercise demarcated a boundary between 'expert' and 'public-interest' views, thus demoting the latter (Purdue, 1995, 1996).

A particular lay/expert boundary was performed by expert witnesses, in the process of being questioned by the lay panel. The panel expressed views about economic, political, legal and ethical issues of agbiotech.

Yet the key questions – and the experts' responses – were largely framed within the technocratic discourses of specialist expert knowledge... It was largely taken for granted that the task of technology assessment depended primarily upon the technical and professional skills of research scientists (Barns, 1995: 203).

The structure implied that experts are needed to help overcome the deficient understanding of the public, though the lay panel often challenged the supposed neutrality of official expertise (ibid.).

[This] set up a functional division of labour: 'lay' people ask questions, while 'experts' provide the answers. Indeed to play out their 'lay' role properly, the 'lay' panel was obliged... to show appropriate deference to the 'experts' and the organisers. The 'lay' panel was thus encouraged to take on the challenge of investigating biotechnology, but from an exaggerated position of innocence and ignorance (Purdue, 1995).

The whole construction of their layness induced an undue deference to the experts, irrespective of the expert's actual level and area of competence (Purdue, 1996: 533).

The lay/expert boundary was reinforced in the final, public stage of the process. There the chairman tended to give pro-biotechnology speakers the status of 'mobile experts', knowledgeable on diverse aspects. By contrast, NGO activists were put on the defensive to demonstrate their expertise (ibid.).

The process raised wide-ranging questions and disagreements, even within the Panel. Nevertheless, the organizers instructed the panellists to present a single report, permitting no minority views (Purdue, 1996: 537). Consequently, some critical views were marginalized in the panel's report, as if there were consensus on how to define risks and benefits.

Particularly marginalized were concerns about who would legitimately direct biotechnological innovation. Among themselves, panel members raised issues about who was 'in control' – e.g. concerns about R&D priorities, environmental monitoring and accountability (Joss and Durant, 1995: 82). In the panel's report, these issues were largely reduced to safety controls and patent issues.

Having listed potential benefits and risks, the report concluded: 'Biotechnology could change the world, but in order for it to be used effectively – maximising benefits and minimising risks – we also need to adapt economic and social structures to take account of the changes it might produce'. By contrast to government policy, the panel opposed any extension of patent rights; it also advocated mandatory labelling of GM food for the public right to choose. In particular: 'Regulatory control in the UK is among the most stringent; however, there is still room for improvement' (Science Museum/BBSRC, 1994: 7, 14). Although questioning some pro-biotech arguments, the report reinforced a common societal problem of product safety, while adding the principle of consumer choice.

After the panel presented its final report, the document was interpreted in divergent ways. According to the organizers, 'the lay panel has given the field of plant biotechnology its qualified support' (Science Museum, 1994: 2). However, the report could just as well be read as sceptical; it emphasized not only risks, but also predictable disadvantages of agbiotech. It also criticized inadequacies of government regulation, along lines similar to criticisms by NGOs. One excerpted the report as campaign material, entitled 'Whose consensus?', emphasising differences between the panel's report and government policy (Genetics Forum, 1994).

The UK exercise sought mainly to explore 'the public understanding of science' in Britain (Joss and Durant, 1995: 76, 96, 104 n14), according to the conference organizers. They claimed 'to adopt the Danish model of the consensus conference', yet this aims to generate a wider societal debate that

could influence the Parliament and government. The UK exercise anyway had little potential for such influence: Parliament had no relevant policy decision at that time (ibid: 99), and there was little public debate on agbiotech.

In any case, the lay panel had little means to challenge the UK risk-benefit framework, even if it had presented minority views. A more significant policy challenge was coming from the opposite direction. UK regulatory procedures then were facing deregulatory pressure from the agbiotech industry and other Ministries, amidst a Europe-wide campaign against 'over-regulation' (Levidow, 1994). Environment Ministry officials saw the lay panel's report as helpful for protecting their regulatory procedures and expertise from such pressure.

In all those ways, the UK Consensus Conference reinforced an expert/lay boundary within the UK's risk-benefit policy framework. The Panel recommended regulatory adaptations to ensure that agbiotech would be kept beneficial and safe. Although individual panel members raised issues about corporate-biotechnological control over the agri-food chain, these were reduced to regulatory control measures, e.g. safety regulation and product labelling. This framework implied little scope for public participation in definitions of risk or benefit, much less in innovation priorities. Policy issues could be implicitly delegated to expert bodies through normative assumptions in their advice.

8 France 1998: neutrality of the expert state

By 1997 French regulatory policy faced a legitimacy crisis. France had led efforts to gain EU-wide approval for GM crops, yet these were now opposed by a broad range of organizations. The Confederation Paysanne, representing farmers who elaborated a peasant identity, opposed agbiotech while counterposing 'quality' alternatives to industrialized agriculture (Heller, 2002). An oppositional petition was signed by many prominent scientists, not necessarily anti-agbiotech, but all of them concerned about regulatory failures to develop appropriate ecological expertise and risk research (Marris, 2001).

In February 1997 the Prime Minister decided not to authorise commercial cultivation of Ciba-Geigy's Bt 176 GM maize in France, even though French regulators had led EU authorisation of the same product. This unstable policy indicated a crisis of official expertise within an elite-technocratic political culture. According to some critics, an official 'objectivity' too narrowly defined the relevant expertise. As an alternative approach, expert procedures would open up a scientific critique of possible options; this space would provide the expertise necessary for decisions (Roqueplo, 1996: 67, my paraphrase). By incorporating counter-expertise, regulatory procedures would develop an *expertise contradictoire* (contradictory expertise), which would enhance democratic debate and state accountability for decisions.

- Citizens' Conference

In November 1997 the government announced a set of measures, including a plan to sponsor a consensus conference on GMOs, by reference to the Danish Model. This event was later officially called a Citizens' Conference. As an official rationale, this event would provide 'a new way of elaborating decisions' and a means to implement 'participatory democracy', according to the Ministry of Agriculture. Yet the government never clarified the relation between the citizens' conference and its own decision-making procedure (Marris and Joly, 1999). This relation was subtly played out within the conference process, especially by defining expert roles.

From the start, the conference was designed to re-assert the benign expertise of the state, especially the Parliament, which saw itself as the only legitimate representative of the Nation. Organisation of the citizens' conference was delegated to a Parliamentary unit, Office Parlementaire d'Évaluation des Choix Scientifiques et Technologiques (OPECST), which symbolised a political neutrality separate from the government. OPECST appointed the steering committee, which in turn decided that the panel membership should represent diverse views of ordinary citizens – rather than stakeholders in the debate. It also decided which 'experts' – all of them scientists – would give briefings or testimony to the panel, thus framing the issues in advance (Marris and Joly, 1999). The organisers saw those arrangements as necessary 'to prepare a public debate which is not taken over by one side

or the other', i.e. to correct or avoid biases in the existing public debate (OPECST, 1998a). Implicitly, such biases included anti-agbiotech NGOs on one side and Monsanto on the other side, especially from the perspective of the Left-Green Parliamentary majority.

Held in 1998, the conference included different framings of the policy problem. At the public hearings, the citizens' panel often challenged claims by experts about risks and benefits of GM crops. According to the panel's report, control by multinational companies could threaten farmers' independence. Genetically altered species pose a risk of standardisation. And GM rapeseed poses known risks of uncontrolled proliferation, both through pollen and seeds. Nevertheless GM crops could bring economic benefits to European agriculture (OPECST, 1998b; Boy et al., 1998). Together these arguments implied the need for national public-sector expertise in agbiotech innovation.

The panel's recommendations focused on institutional arrangements for better managing agricultural biotechnology. Such measures included the following: greater social participation in scientific advice; public-sector research on ecological risks and agbiotech innovation; a system to ensure traceability of food derived from GM crops; and adequate labelling to inform consumer choice. 'Until these conditions are satisfied, part of the panel believes that a moratorium would be advisable' (ibid.). By advocating state funds for agbiotech innovation, the panel accepted the government's problem-definition of a national technological gap whose solution requires public-funded science, presumed to be benign. The panel's concerns about rapeseed complemented the French government's decision to oppose approval of GM herbicide-tolerant rape, on grounds that gene flow could complicate weed control (Marris and Joly, 1999).

The panel's conclusions were translated into policy advice by the Parliamentary organisers, as if they were neutral experts in the public good. Moreover, having attended the proceedings, the OPECST President presumed to speak for the panel:

Taking all these views into account he then himself adopted a position on a number of topics...

He has identified the issues and looked into peoples' fears and concerns (OPECST, 1998b). This translation can be illustrated by the strategic issue of how to structure expert advice. The panel had proposed that a citizens' commission should be part of the scientific advisory committee. Yet OPECST recommended instead that it be kept separate; this proposal could better perpetuate a neutral image of scientific advice, thus reinforcing a boundary between expert/lay roles.

The panel's advice anticipated the general direction of government policy: more stringent regulatory criteria, risk assessment by a broader scientific expertise, and 'independent' risk research, which was equated with public-sector institutes. It helped to legitimise and reinforce such initiatives, which had not been universally accepted within the government beforehand. In June 1998 the government announced measures along those lines (Marris and Joly, 1999). Institutional reforms emphasized expert procedures to minimize the risks and enhance the benefits of a controversial technology.

Despite its limitations, the citizens' conference initiated a new form of active public representation and knowledge-production. Panel members explored techno-scientific and social aspects together from the perspective of ordinary citizens. They sought to inform decision-makers about the views of those who do not normally speak out – and who do not feel represented by political parties, trade unions, or environmental and consumer NGOs. This potential for participatory evaluation, especially for considering alternative options, was limited by the overall structure, especially the small opportunity to interact with designated experts (Joly et al., 2003).

- Technocratic governance

Overall the citizens' conference was used to legitimise state claims to represent the public good, especially through expert roles. OPECST selectively promoted some accounts of agbiotech and its regulation as the expert ones, while explicitly speaking on behalf of citizens. The Agriculture Ministry had claimed to implement 'participatory democracy', yet the exercise extended the French tradition of technocratic governance (Marris and Joly, 1999).

Within this framework, expert roles remained the exclusive realm of the state authorities and their officially designated advisors. Ordinary people could question experts and recommend institutional reforms, but Parliamentary experts would officially speak for them. Thus the process reinforced lay/expert boundaries, in the face of public challenges to the official expertise for agbiotech.

9 UK 2003 Public Dialogue: policing boundaries

From the late 1990s onwards the UK had a widespread public controversy over agbiotech. Protest actions and attacks on field trials gained public support by linking GM crops with various issues – BSE, other food scares, globalisation, ‘pollution’, etc. (Levidow, 2000). The government faced an impasse over regulatory decisions, especially the criteria for permitting a GM herbicide-tolerant maize which the EU had approved in 1998. As a key issue, conservation agencies had warned that changes in herbicide usage could harm farmland biodiversity, so the government funded farm-scale trials to monitor such effects.

To address wider issues beyond risk regulation, the government had created the Agricultural and Environment Biotechnology Commission in 2000. Its report, *Crops on Trial*, advised the government to initiate an ‘open and inclusive process of decision-making’ within a framework that extends to broader questions than herbicide effects. It proposed a ‘wider public debate involving a series of regional discussion meetings’ (AEBC, 2001: 19, 25). The government was persuaded to sponsor this – alongside the intense, sporadic debate which was occurring anyway.

Called ‘GM Nation?’, the official public debate was carried out in summer 2003. Beforehand the government vaguely promised ‘to take public opinion into account as far as possible’. The exercise was intended for the organisers to gauge public opinion, rather than for participants to deliberate a collective view on expert matters (Horlick-Jones et al., 2006). ‘GM Nation?’ also aimed to elicit views of the ordinary public, rather than organisational representatives – an artificial distinction, given that most civil society organisations and wider social networks had discussed agbiotech in previous years.

An overall Public Dialogue had a tripartite structure which explicitly distinguished between lay and expert issues. ‘GM Nation?’ was designed mainly for the lay public. An expert panel carried out a Science Review of literature relevant to risk assessment. And a government department carried out a Costs and Benefits Review of GM crop cultivation in the UK.

The Public Dialogue was designed in those three separate parts, with an explicit aim that they would work closely together. The three procedures were kept formally separate, yet the supposedly lay and expert issues became intermingled in practice. The official boundaries were both challenged and policed, thus constructing the participants in contradictory ways.

- Representing public views?

‘GM Nation?’ featured several hundred public meetings open to anyone interested, drawing over 20,000 participants (DTI, 2003). When participants in ‘GM Nation?’ largely expressed critical or sceptical views towards agbiotech, arguments ensued over whether they were ‘representative’ of the public. According to a pro-agbiotech coalition, the Agriculture and Biotechnology Council, the exercise was hijacked by anti-biotech activists, so the format was not conducive to a balanced deliberation of the issues.

According to academic analyses, however, that criticism frames the public as atomised individuals who have no prior opinion. The exercise predictably drew a specialised public which was largely suspicious or hostile to agbiotech. Participants represented both themselves as individuals and wider epistemic networks. The debates were filling an institutional void, in the absence of any other formal opportunity to deliberate the wider issues (Reynolds and Szerszynski, 2006).

The government sponsors had asked the contractors to involve ‘people at the grass-roots level whose voice has not been heard’. As the official evaluators noted afterwards, however, it was problematic

to distinguish clearly between ‘an activist minority’ and a ‘disengaged, grass-roots minority’. Many participants in ‘GM Nation?’ were politically engaged in the sense that their beliefs on GM issues formed part of their wider worldview. Yet policymakers tend to construct ‘the public’ as an even-handed majority – and therefore legitimately entitled to participate in engagement exercises (Horlick-Jones et al., 2004: 135; Horlick-Jones et al., 2006). Indeed, ‘grass-roots’ conventionally means local organised activists, yet this term was strangely inverted to mean a passive, uninformed public.

As envisaged by the sponsors, separate focus groups would allow the public to frame the issues according to their own concerns, yet special measures were needed to realise the policymakers’ model of the public. They saw the open meetings as dominated by anti-biotech activists, unrepresentative of the general public. Politically inactive citizens were seen as truly representative and thus as valid sources of public opinion, by contrast to ‘activists’. To exclude the latter individuals from focus groups, candidates underwent surveillance and screening. ‘Perhaps paradoxically, the desire to allow the public to frame the discussion in their own terms led the organisers to rely on private and closely monitored forms of social interaction’. According to this ideal model of the focus groups, the organisers would be listening to the *idiotis*, by analogy to ancient Greek citizens too ignorant to fulfil their responsibilities (Lezaun and Soneryd, 2006: 22-23). In this way, the more informed, expert citizens would be excluded from representing the public.

‘GM Nation?’ was intended to canvass all views and concerns about agbiotech, yet there were boundary disputes over issue-framings, admissible arguments and participants’ roles. Some used the opportunity as politically engaged actors in their own right, not just as indicators of public opinion. Attending shortly after the US-UK attack on Iraq, some participants drew analogies between government claims about agbiotech and about Weapons of Mass Destruction. They suspected that the government was concealing or distorting information in both cases; they wondered whether it would ignore public opinion towards agbiotech, as in the attack on Iraq. Initially the chair tried to steer the discussion back to agbiotech, on grounds that ‘GM Nation?’ was not about the Iraq war, though participants still elaborated the analogy. Thus the public consultation had a disjuncture between public politics and government policy as understood by the sponsors of the exercise (Joss, 2005b: 181).

- Expert/lay roles

For the carefully selected focus groups, the organisers commissioned ‘stimulus material’, so that participants would have a common knowledge-basis for discussion. The Steering Group asked the contractors to supply ‘objective’ information. Yet there were grounds to include ‘opposing views’ because this is often how people encounter information in real life’, according to the official evaluators of ‘GM Nation?’ The ultimate material did include divergent views, but their sources were removed from the workbook for focus groups. Afterwards the official evaluators questioned ‘the extent to which information is meaningful if it is decontextualised by stripping it from its source’ (Horlick-Jones et al., 2004: 93-94; Walls et al., 2005).

Indeed, people often make judgements on the institutional source of expert views, but they had little basis to do so in the ‘GM Nation?’ focus groups. Omission of the sources was not simply a design deficiency in the exercise. By default, the issue of expert credibility was diverted and reduced to scientific information about biophysical risk. Participants had little basis to evaluate such information, so the exercise constructed a lay/expert boundary, constraining public roles even more narrowly than in the wider public debate.

Separate from ‘GM Nation?’, the GM Science Review was officially limited to a panel of experts evaluating scientific information. At the same time, relevant NGOs were consulted about experts who could represent their views on the panel. In this way, panel members were selected along relatively inclusive lines, encompassing a wide range of views about GM crops. As these selection criteria recognised, the public did not regard scientific expertise as a neutral resource (Hansen, 2006: 580), so the Panel’s public credibility would depend upon a diverse composition. Although the Panel’s report identified no specific risks, it emphasised uncertainties and knowledge-gaps important

for future risk assessment of GM products (GM Science Review, 2003). These uncertainties implied scope for a wider public role in expert judgements.

As a high-profile part of the GM Science Review, the Royal Society announced a meeting to 'examine the scientific basis' of various positions. Opening the event, the chair announced the laudable aim 'to clarify what we know and do not know' about potential effects of GM crops. In the morning, agro-ecological issues were analysed in a rigorous way, especially for their relevance to the prospect that broad-spectrum herbicides may be widely used in the future. But those complexities were ignored when considering GM herbicide-tolerant crops in the afternoon (Levidow, 2003). By downplaying expert ignorance, the overall structure did not facilitate a debate about knowledge versus ignorance, nor provide much basis for public involvement.

Moreover, the boundaries of 'science' were policed along pro-biotech lines. Inconvenient issues, findings or views were deemed non-scientific. For example, speakers freely advocated the need for agbiotech to solve global problems, e.g. environmental degradation, the food supply, etc, but the chair cut off anyone who questioned these claims – for going beyond science (ibid.). Thus biotechnological framing assumptions were reinforced as 'science', along with the expert status of their proponents – while sceptics were marginalised as merely expressing lay views on extra-scientific issues.

In sum, the UK Public Dialogue involved a struggle over how to construct the public, especially in relation to expertise. The structure and management imposed boundaries between apolitical grassroots versus activist, as well as between lay versus expert status. Nevertheless participants challenged those boundaries, performed different models of the public and questioned dominant expert assumptions.

10 Conclusions: performing publics

The Introduction posed the following questions:

How and why did state bodies sponsor participatory technology assessment of agbiotech?

What aims arose in designing, managing and using those exercises?

How did the process shape relations between expert and lay roles?

How did participants raise questions about agbiotech and government policy?

How did the overall process bear upon the accountability of representative democracy?

Since the 1980s various state bodies in Europe have sponsored a participatory technology assessment (TA) of agbiotech; this can be analysed as a specific type of arena with diverse forms and contexts. In most national contexts, agbiotech was being officially promoted as an essential source of eco-efficient GM products, whose safety would be validated by experts as the only necessary scrutiny. These neoliberal policy frameworks were increasingly challenged by autonomous citizen initiatives.

In responding to or anticipating public concerns about agbiotech, participatory TA exercises were sponsored with diverse, overlapping, even contradictory aims. From various deficit models of public unease, sponsors and other advocates sought to democratise technology, to educate the public, to counter 'extreme' views, to gauge public attitudes, to guide institutional reforms, and/or to manage societal conflicts. Such aims had a bearing upon the design, management, staging and process of each exercise. Each process manifest diverse accounts of technology, the public, expertise and democracy (cf. Joss, 2005a).

In these TA exercises, individuals were pre-selected to participate in a group process, questioning expert claims in order to reach a group view. Participants deliberated the normative, value-laden basis of expert claims, thus developing a lay expertise; they went beyond simply questioning experts (cf. Kerr, 1998; Wakeford, 1998). By contrast to a negotiation among interest-groups, participants addressed the public good by appealing to common societal interests and problems (cf. Hamlett, 2003).

However, dominant problem-definitions incorporated or marginalised critical voices. Some problems were treated as common ones for group deliberation, while others were ignored or marginalised as uncommon ones, inconvenient for a group consensus or for a thinkable government policy. Some participants questioned whether agbiotech would provide a means for sustainable agriculture and a benign control over the agri-food chain; some suggested the need for alternatives. These questions were generally channelled into regulatory criteria and reduced to control measures.

In such ways, participatory TA exercises biotechnologised democracy. Discussion generally focused on appropriate regulatory arrangements for agbiotech, represented as a series of potentially beneficial products; at issue was how to minimise risks and maximise benefits. Conflicts over societal futures can be managed 'by re-absorbing discourses of polarity into a system of "legitimate differences"' and by defining the locations where differences can be articulated' (Gottweis, 1998).

Regardless of other views held by participants, any wider deliberation was constrained – by a search for consensus, by the design of each exercise, and by the government policy framework. This overall context limited what could be said with influence on the process, and thus what roles could be credibly performed by participants (cf. Hajer, 2005). The process internalised and reinforced policy assumptions about agbiotech as essential progress – albeit perhaps warranting more rigorous, publicly accountable regulation. Through a discursive depoliticisation, contentious issues were displaced onto the management problems of an inevitable future, as in neoliberal governance more generally (cf. Goven, 2006; Pestre, 2007). Consequently, tensions arose between discussing a 'common' problem – how to make agbiotech safe or acceptable – versus encompassing problems of political-economic control, innovation choices and societal futures.

Those tensions took the form of various boundary conflicts, which erupted more starkly in some cases. In the German TA exercise, as an extreme case, the NGO representatives could maintain their official expert status only by accepting a risk-benefit framework. Instead they rejected these terms for participation, demanded a broadly comparative assessment, and thus were relegated to the lay public or irrational objectors. In the 2003 UK Public Dialogue, the official structure nominally separated all relevant issues into three components – public concerns, scientific risk assessment, and economic benefits; accordingly, expert matters were formally separated from other issues for discussion by lay participants. Despite that official tripartite structure, all the issues became mixed in practice; their boundaries were both contested and policed.

In the design and management of the TA exercises, then, boundaries were imposed – between biotechnological imperatives versus alternative options, between scientific versus policy issues, as well as between expert versus lay roles – thus closing down issues. By contesting those boundaries, some participants opened up policy issues and performed different models of the public, implying broader roles for citizens. These performative interactions produced different understandings of the policy problem (cf. Hajer, 2005). . If analysed in this way, then public engagement can 'clarify what conflict is really about' (de Marchi, 2003).

In each TA exercise, issues were opened up beyond the government policy framework, though they remained more narrow than in the parallel public debate. Ultimately the process reinforced official boundaries between scientific and extra-scientific issues, as well as between expert and lay roles (though these boundaries took different forms across the national cases). Agbiotech was being co-produced along with particular models of expertise, citizenship and their relationship. Institutions were created or adapted in designing and managing each TA process accordingly.

To some extent, state-sponsored participatory TA exercises anticipated, stimulated or reinforced policy changes which enhance the state's accountability for regulatory frameworks. Such outcomes depended upon a longer-term socio-political agency beyond the TA exercise and its panel. However, the TA exercises did not help publics to hold the state accountable for its commitment to agbiotech as an objective imperative.

What does this mean for efforts to democratise technology?

... appraisal conducted in 'opening up' mode might be seen as substantively more coherent and normatively more consistent with the prevailing institutions and procedures of representative democracy (Stirling, 2005: 229).

In practice, the relationship between representative democracy and participatory methods becomes most clear and complementary, when engagement is approached as a means to open up the range of possible decisions, rather than as a way to close this down. Choice among the options thereby identified then becomes a clearer matter of democratic accountability (Stirling, 2006: 5).

In the state-sponsored cases analysed here, participatory methods and representative democracy do not seem complementary. Or perhaps they are perversely so. In performing publics, participation symbolically set boundaries on citizen roles and closed down innovation (non)choices. By default, if not by design, such issues were channelled into regulatory arenas, which thereby carried the burden of conflicts over societal futures. Thus state-sponsored participatory TA readily complements neoliberal representative democracy and its unaccountability, while reproducing its contradictions through contested boundaries. Democratic accountability remains a task for a wider societal contest over normative commitments and pre-empted futures.

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- Critical Social Science for/on Contentious Technologies, workshop in November 2006, Egenis Centre, Exeter
- Critical Issues in Science and Technology Studies, 6th Annual IAS-STs Conference, May 2007, Graz
- Science and Democracy Network annual meeting, June 2007, Cambridge, UK.

References

- Barben, D. (1998) 'The political economy of genetic engineering', *Organization & Environment* 11, 4: 406-422.
- Barns, I. (1995) 'Manufacturing consensus? Reflections on the UK National Consensus Conference on Plant Biotechnology', *Science as Culture* 5(2): 200-16.
- Burgess, J. and Chilvers, J. (2006) 'Upping the ante: a conceptual framework for designing and evaluating participatory technology assessment', *Science and Public Policy* 33(10): 713-28.
- CEC (1993) 'Growth, Competitiveness, Employment: The Challenges and Ways Forward into the 21st Century', *Bulletin of the European Communities*, supplement 6/93. Brussels: Commission of the European Communities.
- CEC 2001a. *European Governance: A White Paper*, Commission of the European Communities, http://europa.eu.int/comm/governance/white_paper/index_en.htm
- CEC 2001b. *A Sustainable Europe for a Better World: A European Union Strategy for Sustainable Development*, COM (2001) 264, www.europa.eu.int
- CEC 2002. *Towards a Strategic Vision of Biotechnology and Life Sciences*, <http://europa.eu.int/comm/biotechnology>
- CGG 1995. Commission on Global Governance, *Our Global Neighborhood*, Oxford: Oxford University Press.
- Charles, D. (2001) *Lords of the Harvest: Biotech, Big Money and the Future of Food*. Cambridge, MA: Perseus.
- De Marchi, B. 2003. 'Public participation and risk governance', *Science & Public Policy* 30, 3: 171-76.
- De Marchi, B. and Ravetz, J. 1999. 'Risk management and governance: a post-normal science approach', *Futures* 31: 743-57.
- DFS (2006) 'Educate democracy', Dansk Folkeoplysnings Samråd, www.dfs.dk, Danish Adult Education Association
- Dreyer, M. and Gill, B. 2000. 'Germany: continued "elite precaution" alongside continued public opposition', *Journal of Risk Research*, 3, 3: 219-26.
- DTI (2003) reports on GM Nation?, London: Dept of Trade & Industry, www.gmnation.org.uk/
- Dubreuil, G.H., Bengtsson, G., Foster, R., Gadbois, S., Kelly, G.N., Lebessis, N., Lochard, J., Pape, R. (2002) 'A report of TRUSTNET on risk governance: lessons learned', *Jnl of Risk Research* 5, 1: 83-95.
- EEC (1990) Council Directive 90/220 on the Deliberate Release to the Environment of Genetically Modified Organisms, Official Journal of the European Communities, L 117, 8 May: 15-27
- EC 2001. European Parliament and Council Directive 2001/18/EC of 12 March on the deliberate release into the environment of genetically modified organisms and repealing Council Directive 90/220/EEC, *O.J. L* 106: 1-38.
- EGSG (2007) Ulrike Felt, rapporteur, Brian Wynne, chair, *Science and Governance: Taking European Knowledge Society Seriously: Report of the Expert Group on Science and Governance to the Science, Economy and Society Directorate, Directorate-General for Research, European Commission*. Brussels: European Commission, EUR 22700, [http://www.bmbf.de/pub/EuropeanKnowledge\(1\).pdf](http://www.bmbf.de/pub/EuropeanKnowledge(1).pdf)
- Einsiedel, E.F., Jelsøe, E. and Breck, T. (2001) 'Publics at the technology table: The consensus conference in Denmark, Canada, and Australia', *Public Understanding of Science* (10): 83-98.
- Einsiedel, E. and Kamara, M.W. (2006) 'The coming of age of public participation', in G.Gaskell and M.Bauer, eds, *Genomics and Society: legal, ethical and social dimensions*, London: Earthscan, pp.95-112.

- Elert, C. et al. (1991) *Biotechnology at Work in Denmark*. Copenhagen: Danish Board of Technology (Teknologinævnet).
- Epstein, E. (1995) The construction of lay expertise: AIDS activism and the forging of credibility in the reform of clinical trials, *Science, Technology and Human Values* 20(4): 408-37.
- Ferretti, M.P. (2007) 'What do we expect from public participation? The case of authorising GMO products in the European Union', *Science as Culture* 16(4), forthcoming.
- Fischer, F. (1999) 'Technological deliberation in a democratic society: the case for participatory inquiry', *Science and Public Policy* 26(5): 294-302.
- Fischer, F. (2000) *Citizens, Experts and the Environment: The Politics of Local Knowledge*. Durham/London: Duke.
- Frewer, L. and Rowe, G. (2004) 'Evaluating public-participation exercises: a research agenda', *Science, Technology and Human Values* 29(4): 512-57.
- Genetics Forum (1994) 'Whose consensus?', *The Splice of Life*, December.
- Gill, B. 1993. 'Technology assessment in Germany's biotechnology debate', *Science as Culture*, 4, 1: 69-84.
- Gill, B. 1996. 'Germany: splicing genes, splitting society', *Science and Public Policy*, 23, 3: 175-179.
- Gill, S. 1993. *Gramsci, Historical Materialism and International Relations*. Cambridge: Cambridge University Press.
- GM Science Review (2003) *First Report: An open review of the science relevant to GM crops and food based on the interests and concerns of the public*. London: GM Science Review Panel, www.gmsciencedebate.org.uk/report/pdf/gmsci-report1-pt1.pdf
- Gottweis, H. (1998) *Governing Molecules: The Discursive Politics of Genetic Engineering in Europe and the United States*. MIT Press.
- Goven, J. 2006. 'Dialogue, governance and biotechnology: acknowledging the context of the conversation', *Integrated Assessment Journal* 6, 2: 99-116.
- Grint, J. and Woolgar, S. (1997) *The Machine at Work: Technology, Work and Organisation*. Cambridge Univ Press
- Grundahl, J. (1995) 'The Danish consensus conference model', in S. and J. Durant, eds, *Public Participation in Science: the Role of Consensus Conferences in Europe*, pp.31-40. London: Science Museum.
- Hagendijk, R. and Irwin, A. (2006) 'Public deliberation and governance: engaging with science and technology in contemporary Europe', *Minerva* 44(2): 167-84.
- Hajer, M. 2005 'Setting the stage: a dramaturgy of policy deliberation', *Administration & Society* 36(6): 624-47.
- Hamlett, P. (2003) 'Technology theory and deliberative theory', *Science, Technology and Human Values* 28(1): 122-40.
- Hansen, L. et al. (1992) 'Consensus Conferences', Copenhagen: Danish Board of Technology.
- Hansen, Janus (2006) 'Operationalising the public in participatory technology assessment', *Science and Public Policy* 33(8): 571-584.
- Heller, C. 2002. 'From scientific risk to *paysan savoir-faire*: peasant expertise in the French and global debate over GM crops', *Science as Culture*, 11, 1: 5-37.
- Horlick-Jones, T. et al 2004. *A Deliberative Future? An Independent Evaluation of the GM Nation? Public Debate about the Possible Commercialisation of Transgenic Crops in Britain, 2003*, Understanding Risk Working Paper 04-02, Norwich: University of East Anglia.
- Horlick-Jones, T., Walls, J., Rowe, G., Pidgeon, N., Poortinga, W., O'Riordan, T. (2006) 'On evaluating the GM Nation? Public debate about the commercialisation of transgenic crops in Britain', *New Genetics and Society* 25(3): 265-88.
- Irwin, A. 2006. 'The politics of talk: coming to terms with the "new" scientific governance', *Social Studies of Science* 36, 2: 299-320.
- James, P., Kemper, F., Pascal, G. 1999. *The Future of Scientific Advice in the EU*.
- Jasanoff, S. (2005) *Designs on Nature: Science and Democracy in Europe and the United States*, Princeton: Princeton University Press.
- Joly, P.-B.; Marris, C., Hermitte, M.A. (2003). A la recherche d'une 'démocratie technique'. Enseignements de la conférence citoyenne sur les OGM en France, *Natures, Sciences et Sociétés* 11(1): 3-15.
- Joss, S. (1998) 'The Danish consensus conferences as model of participatory technology assessment', *Science & Public Policy* 25 (1): 2-22.
- Joss, S. and Durant, J., eds (1995) *Public Participation in Science: the Role of Consensus Conferences in Europe*. London: Science Museum.
- Joss, S. 2005a. 'Lost in translation? Challenges for participatory governance of science and technology', in H. Torgersen and A. Bogner, eds, *Wozu Experten/Why Experts?* Pp. 197-219. Verlag für Sozialwissenschaften.
- Joss, S. 2005b. 'Between policy and politics', in S.Maasen and P.Weingart (editors), *Democratization of Expertise? Exploring Novel Forms of Scientific Advice in Political Decision-Making*, pp.171-88, Dordrecht: Springer, Sociology of the Sciences Yearbook.
- Kerr, A., Cunningham-Burley, S., Amos, A., 1998. The new genetics and health: mobilizing lay expertise, *Public Understanding of Science* 7: 41-60

- Klüver, L. 1995. 'Consensus conferences at the Danish Board of Technology', in S. Joss and J. Durant (editors), *Public Participation in Science: the Role of Consensus Conferences in Europe*, pp.41-49. London: Science Museum.
- Klüver, L. 2006. 'New trends in public participation', PATH conference, <http://www.macauley.ac.uk/pathconference>
- Levidow, L. (1994) 'Biotechnology regulation as symbolic normalization', *Technology Analysis and Strategic Management* 6(3): 273-88.
- Levidow, L. 1998. 'Democratizing technology – or technologizing democracy? Regulating agricultural biotechnology in Europe', *Technology in Society* 20, 2: 211-26.
- Levidow, L. (2000) 'Pollution metaphors in the UK biotechnology controversy', *Science as Culture* 9(3): 325-51.
- Levidow, L. 2003. 'Policing the Scientific Debate on GM Crops: the Royal Society meeting of 11th Feb 2003', <http://www.gmsciencedebate.org.uk/topics/forum/0070.htm>
- Levidow, L. and Carr, S. (forthcoming, 2008) *GM Food on Trial: Contesting European Democracy*, Routledge.
- Levidow, L. and Marris, C. 2001. 'Science and governance in Europe: lessons from the case of agbiotech', *Science and Public Policy*, 28, 5: 345-360.
- Levidow, L., Carr, S., von Schomberg, R., Wield, D. (1996) 'Regulating agricultural biotechnology in Europe: harmonization difficulties, opportunities, dilemmas', *Science & Public Policy* 23(3): 135-57.
- Levidow, L., Carr, S., Wield, D. (2000) 'Genetically modified crops in the European Union: regulatory conflicts as precautionary opportunities', *Journal of Risk Research* 3(3): 189–208.
- Levidow, L., Sjøgaard, V. and Carr, S. 2002. 'Agricultural PSREs in Western Europe: research priorities in conflict', *Science and Public Policy* 29, 4: 287-95.
- Levidow, L., Carr, S., Wield, D. (2005) 'EU regulation of agri-biotechnology: precautionary links between science, expertise and policy', *Science & Public Policy* 32(4): 261-76.
- Lezaun, J. and Soneryd, L. 2006. *Government by Elicitation: Engaging Stakeholders or Listening to the Idiots?*. London: LSE CARR Discussion Paper no.34, www.lse.ac.uk/Depts/carr
- Liberatore, A., rapporteur 2001. 'Democratising Expertise and Establishing Scientific Reference Systems', Report of the Working Group 1b, Broadening and enriching the public debate on European matters, *White Paper on European Governance*, http://ec.europa.eu/comm/governance/areas/group2/index_en.htm.
- Marris, C. and Joly, P-B. 1999. 'Between consensus and citizens: public participation in technology assessment in France', *Science Studies*, 12, 2: 3-32.
- Marris, C. (2001) Swings and roundabouts: French public policy on agricultural GMOs since 1996, *Politeia* 60: 22-37.
- Moreau Defarges, P. (2001) 'Gouvernance', *Le Débat* 115: 165-172.
- Murphy, J. and Levidow, L. (2006) *Governing the Transatlantic Conflict over Agricultural Biotechnology: Contending Coalitions, Trade Liberalisation and Standard Setting*. London: Routledge.
- Newell, P. 2003. 'Globalization and the governance of biotechnology', *Global Environmental Politics*, 3, 2: 56-71.
- NOAH (2006) NOAH Gene-technology group, <http://www.noah.dk/gentek/gtenglish.html>
- OPECST 1998a. Letter from Steering Committee to participants in the preparatory weekends, 16 April.
- OPECST 1998b. Conférence de Citoyens Sur l'Utilisation des Organismes Génétiquement Modifiés en Agriculture et dans l'Alimentation. Paris: L'Office Parlementaire d'Évaluation des Choix Scientifiques et Technologiques (OPECST), Assemblée Nationale, www.senat.fr/opecest/
- Paterson, M. 2000. *Understanding Global Environmental Politics: Domination, Accumulation, Resistance*. London: Palgrave.
- Pellizoni, L. 2003. 'Uncertainty and participatory democracy', *Environmental Values* 12: 195-224.
- Pestre, D. 2007 Participation, governance and politics today, *Science as Culture*, forthcoming
- Popper, K.R. (1962) *The Open Society and Its Enemies*, vol. 1
- Purdue, D. (1995) 'Whose knowledge counts? "Experts", "counter-experts" and the "lay" public', *The Ecologist*, Sept-Oct, 25(5): 170-72 .
- Purdue, D. (1996) 'Contested expertise: plant biotechnology and social movements', *Science as Culture* 5(4): 526-45.
- Reynolds, L. and Szerszynski, B. 2006. 'Representing GM Nation', PATH conference, proceedings at <http://www.macauley.ac.uk/pathconference>
- Roqueplo, P. (1996) *Entre savoir et decision, l'expertise scientifique*. Paris: INRA.
- SBC 2001. *Stakeholder Dialogue on Environmental Risks and Safety of GM Plants*, workshop report by Schenkelaars Biotechnology Consultancy on behalf of the EFB Task Group on Public Perceptions of Biotechnology, www.sbcbiotech.nl
- SBC 2002. *Report of a European Workshop: Public Information and Public Participation in the Context of EU Directives 90/220 and 2001/18*. <http://www.consubiotech.nl/index2.html>
- Science Museum (1994) *UK National Consensus Conference on Plant Biotechnology: Final Report*, <http://www.ncbe.reading.ac.uk/NCBE/GMFOOD/conference.html>
- Sperling, S. (2007) 'Knowledge rites and the right not to know', *PoLAR*, forthcoming.

- Stirling, A. 2005. 'Opening up or closing down? Analysis, participation and power in the social appraisal of technology', in M. Leach, I. Scoones and B. Wynne (editors), *Science and Citizens: Globalisation and the Challenge of Engagement*, Zed, London, pp.218-31.
- Stirling, A. 2006. 'From science and society to science in society: Towards a framework for 'co-operative research'', Report of a European Commission workshop, 24-25 November 2005, www.cipast.org, <http://eurosfaire.prd.fr/7pc/bibliotheque/consulter.php?id=308>
- Teknologinævnet (1987) *Genteknologi i industri og landbrug*. Teknologinævnets Rapporter 1987/2 og 1987/4.
- Teknologinævnet 1999, Final document of the consensus conference on genetically-modified foods, Copenhagen: Danish Board of Technology, www.tekno.dk
- Toft, J. 1996. 'Denmark: seeking a broad-based consensus on gene technology', *Science & Public Policy* 23, 3: 171-74.
- Toft, J. 2000. 'Denmark, potential polarization or consensus?', *Journal of Risk Research* 3, 3: 227-36.
- Trustnet Secretariat 2000. *The TRUSTNET Framework: A New Perspective on Risk Governance*, <http://www.trustnetgovernance.com>
- van den Daele, W. 1994. *Technology Assessment as a Political Experiment*. Berlin: Wissenschaftszentrum.
- van den Daele, W. 1995. 'Technology assessment as a political experiment', in R. von Schomberg (editor), *Contested Technology: Ethics, Risk and Public Debate*, pp.63-89. Tilburg: International Centre for Human and Public Affairs
- Wakeford, T. (editor) 1998. *Citizen Foresight: A Tool to Enhance Democratic Policy-Making, Part 1: The Future of Food and Agriculture*. London Centre for Governance Innovation and Science and the Genetics Forum, <http://www.ncl.ac.uk/peals/assets/publications/Citizenforesight.pdf>
- Walls, J., Horlick-Jones, T., Niewöhner, J., O'Riordan, T. 2005. 'The meta-governance of risk and new technologies: GM crops and mobile telephones', *Jnl of Risk Research* 8: 635-61.
- Wilsdon, J. and Willis, R. (2004) *See-through Science: Why public engagement needs to move upstream*. London: Demos, www.demos.co.uk
- Wilsdon, J., Wynne, B., Stilgoe, J. (2005) *The Public Value of Science: or how to ensure that science really matters*. London: Demos, www.demos.co.uk
- Wynne, B. 2005. 'Risk as globalising "democratic" discourse? Framing subjects and citizens', in M. Leach, I. Scoones and B. Wynne, eds, *Science and Citizens: Globalisation and the Challenge of Engagement*, London: Zed, pp.66-82.
- Young, O.R. 1994. *International Governance: Protecting the Environment in a Stateless Society*, Ithaca, NY: Cornell University Press.
- Young, Oran R. (ed.) 1997. *Global Governance: Drawing Insights from the Environmental Experience*, Cambridge: MIT Press.