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## Publics at the technology table: the consensus conference in Denmark, Canada, and Australia

Edna F. Einsiedel, Erling Jelsøe, and Thomas Breck

One model for direct citizen participation in science-based policy issues is the consensus conference. This article presents a cross-national comparative analysis of three consensus conferences on food biotechnology (in Denmark, Canada, and Australia) held in March 1999. We conclude that the consensus conference model “travels well” (works in multiple national and socio-cultural contexts), being useful beyond its origins in northern Europe. We also provide more detailed conclusions about the food biotechnology issue.

In the last three decades, the role of the public in discussions of technology has evolved from the normative recognition of principle to the implementation of a variety of models for public participation. Perhaps it is more than coincidence that this has occurred against the backdrop of two developments, the first being the increasing prominence of science and technology issues in the political arena. A corollary of this prominence is their greater complexity, which includes the range and unpredictability of their consequences. Second has been the increasing dissatisfaction with the expert-based system for discussing and assessing these issues.

A consequence of these events has been the rise of models that engage citizens directly. One of these models for direct citizen participation that has seen much use in the last decade is called the “consensus conference.” At the heart of this process is a group of 12 to 15 lay citizens, chosen to examine a controversial technological issue. They identify key issue areas, cross-examine experts, then arrive at a consensus position presented to policymakers and the general public. The recent keen interest in this method of public participation in the social assessment of technology raises questions about the efficacy of the approach, particularly when it is applied in different cultural contexts, and about the broader implications of its uses in these different contexts.<sup>1</sup>

In March 1999, three consensus conferences were held on the issue of food biotechnology, one in Calgary, Canada (March 5–7), the second in Canberra, Australia (March 10–12), and the third in Copenhagen (March 12–15). It was the first conference of its type in Canada and Australia and the 18<sup>th</sup> such meeting in Denmark. Denmark is the grandparent of this citizen participation process, having embarked on this broad-based deliberative approach in 1987 when the Danish Board of Technology started using a transformed version of the US consensus conference, and adapted it to its own traditions of public education and participation. The original US version was designed to bring together panels of experts to arrive at a consensus on research findings. Denmark took this consensus model, but had a lay citizen panel in dialogue with experts.

Since then, other European countries such as France, the Netherlands, Norway, Switzerland, and the UK have conducted similar exercises. While the consensus conference has had more than a decade of history in Europe, it had not been implemented outside of this region until recently. In the last three years, this model of public participation has been copied in Japan, South Korea, Australia, New Zealand, the US, and Canada. The explosion of interest in using this model and others involving direct citizen engagement in assessing technological issues allows us the opportunity to examine several questions. First, how does this model of citizen participation do in different contexts? In this instance, a singular opportunity for comparison has presented itself with the occurrence of three such conferences within the same month and on the same issue but in different countries on different continents. Only one other cross-national comparison of this method has been done but this three-country comparison has focused only on European countries.<sup>2</sup> Second, we can focus on the controversial issue of food biotechnology more specifically and look at how three citizen panels constructed this social problem, having gone through similar intensive learning and deliberative processes. These two questions are not related to each other in a simple manner. On the one hand, our examination of the three lay-panels' framing of food biotechnology will allow us to draw conclusions about the ability of the consensus conference to highlight specific problems of food biotechnology and bring further the public discussions in a constructive way within each national socio-cultural context. Because of the correspondence in time and topics, and presupposing that the method is being applied in a consistent way, we expect to find such national differences well expressed in the final documents. On the other hand, one could also assume that analyzing the final documents from the consensus conferences held at the same time in three fairly different countries will also reveal some universal and transcending problems of food biotechnology. Thus, the aim of the project is to test the robustness of consensus conferences as a deliberative tool for democratic technology assessment in relation to both perspectives.

Our approach was to conduct a comparative analysis of the outcome of the three consensus conferences, focusing on the final reports elaborated by the lay panels at the conferences, the written evaluations of these projects, and our own experiences with these processes.<sup>3</sup> At the same time, we considered the broader contexts of each of the conferences and the organization of the three activities. Since the final reports resulting from discussion and consensus formation are developed out of processes of learning and dialogue with expert panels, they also give an important indication of how lay people in different national and cultural contexts deal with the same controversial technological issue. Much can be said about the specific details of each conference that are beyond the purview of this paper. Our focus rather, beyond a brief description of each country's process, is an examination of the final reports as a way of understanding what citizens bring to a deliberative process afforded by the consensus conference. This, in turn, might suggest the efficacy of such public participation models in an international context and as a tool for managing technology more constructively.

## 1. Citizen participation in policy-making and technology assessment

We locate this analysis within the frame of efforts to engage citizens directly on issues of technology assessment for policy decision-making. This process has been referred to as participatory technology assessment, a description that reflects the intent of direct citizen engagement in the policy process (as opposed to the involvement solely of experts).<sup>4</sup> It has also reflected the interest in moving forward the point at which stakeholder examination of technology occurs, a process called constructive technology assessment.<sup>5</sup> In this context, the intent is to broaden participation in as many phases of technological design rather than simply

in the assessment of impacts. This also allows for the accommodation of a broader range of impacts including societal and environmental ones.

The newly established Board of Technology implemented the Danish model of consensus conferences in 1987. Technology assessment had been the subject of continuing attention in Denmark since the late 1970's when there was considerable public debate around nuclear power, environmental problems, and information technologies.<sup>6</sup> In particular, the rejection of nuclear power in Denmark in the first half of the 1980s became a learning experience for its policy makers.

The Board of Technology was established in 1985 at a time when public debate about biotechnology was fueled by the first concrete plans for industrial production plants for genetically modified organisms (GMO) in Denmark.<sup>7</sup> The task of the Board was twofold: to initiate technology assessment and to encourage and support public debate about technology. The introduction of the consensus conference was only one way of implementing the participatory principle in technology assessment; the second tool employed by the Board was the scenario workshop. The latter takes as its starting point two to four narratives or scenarios on a given issue around which brainstorming sessions are then held and action plans developed.

In a broader sense, the development of the consensus conference must also be seen in the context of the Danish tradition for "people's enlightenment."<sup>8</sup> Since the end of the 19th century, adult education and local debate have been an important part of Danish cultural and political life. Thus, the consensus conference model, as it has been developed in the Danish context, had a specific historical origin in the learning processes related to technology controversies in Denmark and a basis in Danish political culture. It is against this background that the question of the implementation of consensus conferences in other national contexts becomes especially interesting.

The consensus conference process has been described numerous times.<sup>9</sup> As previously indicated, the method involves an intensive learning process undertaken by a panel of citizens, their identification of the key issues or questions around the technology that need to be addressed, followed by discussions with and questioning of an expert panel. This lay-expert discussion, structured by the key questions, is conducted in a public conference. The citizen panelists then develop their responses to these key questions and provide recommendations via a written report delivered to policy makers, the media, and the general public. The key elements then in the consensus conference are the dialogue between lay people and experts and the deliberations conducted by the lay citizens.

The increasing domination of expert or technical knowledge over what are essentially political issues has led to questions about the democratic base for technology-based decisions and their consequent legitimacy. Such technical expertise, reliant primarily on instrumental rationality, leaves little room for accommodating broader social values and concerns. The consensus conference represents a way of coping with these problems of decision-making. It might be argued that it comes with its own set of problems, especially with respect to representation of the lay panel. However, the consensus conference is used not as an alternative to, but rather as an extension of, existing democratic structures. As such, it is a way to ensure that complex problems in which science and technology are important are discussed with the involvement of lay people. The writing of the final document, formulated by the lay panel through a deliberative consensus seeking process, further represents an integrated view of the issue in question, taking into account the various views and social values within the group as well as the opinions of a diverse group of experts.

Mayer and Geurts describe the conditions under which such a model of citizen participation may be suitable: (1) when there is a technology question of current societal interest with

significant implications for the future; (2) when there is controversy surrounding such an issue, usually when there is a clash of social, political, economic or ethical values; (3) when the issue is complex and involves unresolved questions; and (4) when there are many (and competing) interests at stake.<sup>10</sup> The Danish Board of Technology has also suggested additional criteria of relevance—when expert knowledge is needed to deal with an issue and it is possible to delimit the subject.<sup>11</sup> That is, the issue may be complex but can be dealt with within the compressed form of a consensus conference.

The social and political impact of the consensus conference may be divided into three different categories.<sup>12</sup> The first one is the substantive impact on the ensuing public debate and on political decisions. There are a number of examples of such influences in Denmark. For example, when the lay panel at the first Danish conference in 1987 recommended against genetic engineering on animals, the Danish Parliament decided not to fund such projects in the first biotechnology research and development program between 1987–1990. Within this category of impacts falls the wider influence on the national debate and the views of important actors within the field. Such influences are more difficult to measure but are also an important outcome of a consensus conference. One measurable indicator in this respect is the amount of press coverage given to the conference and its outcome. A second category is the procedural impact: how do the different stakeholders view the consensus conference? Does the approach—or others like it—get considered or adopted in the arsenal of decision-making tools? Does it get institutionalized? A third area of social impact—also an elusive one to assess—is the symbolic value of the consensus conference as a demonstration of the ability of lay people to take part in complex decisions.

The impacts of a consensus conference are also dependent on the institutional setting. In Denmark, consensus conferences have been institutionalized through the Board of Technology and funded by Parliament. This ensures close connections to politicians and political attention to the outcome of the conferences. The Dutch board with a similar responsibility for technology assessment (the Rathenau Institute) has a more arms-length relationship with government. At the same time, the Institute functions “in an agenda-setting role for policy alternatives related to science and technology.”<sup>13</sup> Its research and consultation program is connected to the Dutch Parliament’s policy initiatives and programs and the Institute’s results are fed directly to parliamentary decision-making fora. In most other countries where only one or a few conferences have been arranged so far, such an institutional setting has not been established and the direct political impact has therefore been dependent on influence through the media and specialist publications, or through ad hoc presentations to policy makers.<sup>14</sup>

Likewise, funding of the conferences in most countries has been dependent on different sources, not necessarily limited to government. While the availability of funding sources could potentially influence the choice of topic, it is not necessarily the determining factor. In fact, independence from some stakeholders may give the process more value. It is interesting that in recent years, a large proportion of the conferences arranged have dealt with various aspects of biotechnology.<sup>15</sup> Whereas the Danish consensus conference on genetically modified foods in 1999 was arranged because it was found by the Board of Technology to be a politically relevant issue, the choice of biotechnology as subject for consensus conferences in other countries may also be influenced by its currency, significance, and controversial dimensions.

## 2. Our case study contexts

Our comparison countries are from different regions of the world and offer different socio-political contexts for examining a common issue within the same participatory model. Australia and Canada are both producer-exporter countries, ranking among the top five agricultural

biotechnology producer countries in 1998.<sup>16</sup> Denmark is also a large exporter of foods but so far, it has neither produced nor exported agricultural products of modern biotechnology on a commercial basis.

The regulation of biotechnology in both Australia and Canada is based on the “product” rather than the “process.”<sup>17</sup> As such, the use of existing regulatory frameworks governs biotechnology products, using the principle of “substantial equivalence.” That is, a potato genetically modified for pest resistance is considered to be “substantially equivalent” if the physical conditions of the end product do not differ from that of a conventional potato, under this regulatory program. In Denmark, on the other hand, food biotechnology undergoes “process-based regulation,” as is the case with other European Union (EU) countries. This means that all novel foods—including those manufactured or produced with the use of recombinant DNA technology—must undergo a specific evaluation process.

The labeling practices of genetically modified products, particularly food, among these three countries also vary. At the time of the conferences, GM foods in Canada and Australia were not labeled. As will be pointed out later, this situation is changing. In the EU, labeling is mandatory for all genetically modified foods if they contain detectable amounts (using a one percent threshold) of foreign DNA or protein. This essentially means that only a small number of foods containing GM ingredients are labeled. For instance, soy bean oil or lecithin, both of which are used in a large number of processed foods, will not have to be labeled according to EU regulation, if they are extracted from genetically modified soybeans.

Of these three countries, Canada has had the highest number of genetically modified food and crop products approved. At the time of the consensus conferences, 42 products had received approval and a number were on the shelves or in use in agriculture. As of 1998, more than 4,300 field trials had already been conducted.<sup>18</sup> In the EU, 1,485 field trials had been carried out as of August 1999, and of these, 34 (or 2.3 percent) were in Denmark. Ten genetically modified foods or food ingredients had been approved in Canada.<sup>19</sup> In Australia, only soy and cotton were the products in use.<sup>20</sup>

In both Australia and Canada, there had been relatively little controversy over the issue of genetically modified foods prior to the consensus conferences. Surveys had also shown that in comparison to Europeans, Canadians tended to be more positively predisposed to biotechnology applications.<sup>21</sup> In contrast, in Denmark and several other EU countries, controversies over food biotechnology had been increasing since 1996, reflected in growing media attention and direct actions and resistance among consumers and retailers.<sup>22</sup> Surveys have shown that attitudes towards food biotechnology are rather negative in Denmark and that Danes are among the most negative in the EU, ranking only second to Austria.<sup>23</sup> In addition, Denmark has a longer history of controversy over biotechnology dating back to the early 1980's when the first plans for industrial application of gene technology became known to the public. Despite these differences, in general, genetically modified food was clearly a more contentious issue in all three countries when compared to other applications of biotechnology such as those in the medical area.<sup>24</sup>

As a final point of comparison, Denmark has had a longer tradition of an open consultation system on gene technology.<sup>25</sup> It was the first country in Europe to pass legislation establishing a restrictive approach to the regulation of genetically modified organisms via its 1986 Environment and Gene Technology Act and has also been singular in its public consultation activities on various applications of biotechnology.<sup>26</sup> The Canadian approach, on the other hand, has generally been a consultative approach limited to key stakeholders. Prior to the consensus conference, Australia appeared to operate along the lines of the British model of reliance on expert scientific committees.

### *The Canadian consensus conference*

The conference, dubbed “the Citizens’ Conference” was a regional one held in Western Canada.<sup>27</sup> The geographic challenges posed by being the second largest country in the world, coupled with distinct regional complexities that have marked the conduct of politics, have led to a strong tradition of regional consultations. This was maintained in the consensus conference approach employed. The Canadian effort was not linked to a specific policy initiative and, in fact, may have been seen as a risky enough initiative that none of the federal ministries were interested in supporting the effort financially.

The project was funded primarily by the national research-granting agency for the social sciences and secondarily by a provincial government community initiative grant. The primary sponsoring institution was a university, with collaboration from two non-governmental organizations (NGOs), the National Institute of Nutrition, and the Food Biotechnology Communications Network. The 15 lay panelists were recruited by advertisements in major metropolitan newspaper dailies, smaller weeklies, radio and cable stations, and was also featured in a news item on the national network. This netted 356 applications that were whittled down to 40 by the project team, using such criteria as gender, age, education, occupation, and province to ensure diversity. From this smaller pool, the 15 panelists were selected by the Advisory Committee of a research scientist and representatives from government, industry, the consumers association, the national environmental network, a research scientist, and the sponsoring institutions.

Prior to this consensus conference, there was little attention in the Canadian media on food biotechnology. This may account for the lack of public discussion up to this point. However, during the three-month period in which the lay panel was engaged, controversies in the UK over a report on harmful effects of transgenic potatoes on mice, which were heavily covered by the British media, began to spill over into Canadian newspapers. Also at this time, Health Canada (the ministry overseeing food and drug approvals) made the decision to reject recombinant bovine somatotropine (rBST)—the hormone used in cows to boost milk production—for use in Canada. The rBST issue had been the only GM food issue of significant public concern and media attention until this point.<sup>28</sup>

### *The Australian consensus conference*

This was a national effort run by the Australian Consumers Association and the Australian Science Museum. A range of government ministries provided funding. Recruitment of participants was done by a research firm via advertising in randomly selected sites for the initial selection stage and an interview process was used to narrow down the list of 200 applicants to the final 14 lay panelists. An intensive interviewing process, which included three separate telephone interviews, provided one basis for final selection.<sup>29</sup> The 17-member Australian Steering Committee oversaw the selection of the facilitator, the expert panel, and communication strategies. Membership on this Committee was drawn from academia, industry, research and development corporations, and two NGO’s.

The consensus conference process was launched independently by the Australian Consumers Association to provide broader input into policy decision-making on biotechnology.<sup>30</sup> Australia has a long tradition of publicly funded research in agriculture, and modern biotechnology has been viewed as a powerful tool in this process. During the 1980’s and 1990’s, biotechnology became one of Australia’s main research foci.<sup>31</sup> Partly due to the strong link between the government and the biotechnology sector in Australia, there had been limited public discussion about genetic engineering. However, in recent years, consumer

protests in the UK began to hear echoes in the Australian consumer movement, with an increase in public awareness about the issue.<sup>32</sup> The consensus conference was intended to pick up on this growing concern and direct it into the political sphere. Nevertheless, amongst the general public, there was a general lack of awareness on the issue and little media coverage prior to the conference, a situation much like that in Canada.<sup>33</sup>

### *The Danish consensus conference*

The Danish Board of Technology, which has been responsible for all previous Danish citizen conferences, held this conference. The council is a publicly financed independent assessment unit set up by the parliament in 1985. Its aim is to initiate technology assessment and encourage a public debate about technological issues and their ethical and social implications. For the 1999 consensus conference, a lay panel of 14 people was recruited by letter from a randomly selected pool of adults. Ten main questions were put together by the lay panel and posed to 13 experts from universities, government, the biotechnology industry, and environmental and consumer NGO's. The conference was spread over four-days, three of them open to the public and one for preparation of the final report.

The Danish conference was not the first one that included questions about genetically modified food. The very first consensus conference in Denmark in 1987 was entitled *Gene Technology in Industry and Agriculture*. In 1992, there was a conference on transgenic animals. These two conferences were related to the debate and policy activities in the 1980s and early 1990s. The conference in 1999 was held after several years of public discussion about food biotechnology initiated by the introduction of the first genetically modified food (Monsanto's soya) on the market in December 1996 and responses to the passing of the EU regulation on novel food in January 1997. In late 1998, a public campaign directed toward consumers was launched by the Danish Consumers Council in collaboration with the biotechnology industry and retailers promoting a more value-oriented debate about food biotechnology, complementing the debate on risk.<sup>34</sup> In November 1998 the Minister of the Environment made a voluntary agreement with the Danish industrial and agricultural organizations and the Danish seed producers about a one-year moratorium for commercial growing of GM crops and sales of GM seeds. The controversies in the UK over harmful effects of transgenic potatoes, which started a few weeks before the conference, also attracted considerable attention in some Danish media. These events formed the background for the discussions that came to dominate the conference.

All in all, the procedures followed for the consensus conference were roughly parallel in all three countries with a few notable exceptions. The lay panel recruitment process was slightly different, with Australia and Canada employing an advertising approach. A randomly selected pool of adults was recruited by letter to the Danish panel. This procedure was introduced in the mid-1990s to cut down on the costs of recruitment advertising—its earlier method of choice—and have the benefit of random selection. The Australian and Canadian final public conferences were done over a three-day period, with the lay panels producing their reports in a marathon overnight session that lasted well into the early morning hours. The Danish conference was held over four days to allow the lay panel more time to write its report. The original practice in Denmark was also a three-day conference, a practice that was changed in 1995.

There were a few variations in the make-up of the expert panel, although by and large, similar categories of experts were utilized. Only one government expert was heard from in Australia while there were four and three, respectively, in the Canadian and Danish expert panels. Perhaps because the Genethics Network was the only organized and active opposition

to gene technology in Australia at the time, the representative of this NGO was heard from at three different times during the expert presentations.

All three panels developed a list of key questions that ranged from six in Canada to 10 from the Danish and Australian panels. The key questions in every case also engendered a further list of sub-questions. These questions became the organizing basis for the panels' final reports (see Table 1).

### 3. Citizen panel views on food biotechnology

By comparing the key questions raised by the three panels and their observations and conclusions in these issue areas, we can identify areas of commonality and difference and link some of the contextual particularities outlined earlier with the responses of each panel.

The areas of concern illuminated by the questions are striking in their similarity. The question of food safety was, not surprisingly, common to all three. While not expressing direct concern about GM food safety, the Canadians discussed specific problems about the use of antibiotic markers and, looking down the road, the uncertainties posed by multi-gene modifications and the ability of the regulatory system to cope with this problem. The Danes admitted to difficulty in assessing whether the risks of GM foods were any higher than other new foods.

All three panels expressed deep concern about the increasing dominance of a few players in the economic control of the food industry—from paddock to plate, as the Australians put it. They pointed to the use of patents by industries as a way of furthering their monopoly interests and the Danes in particular proposed putting limits to patent terms. Concern was also expressed about terminator seeds and the promotion of this technology as a way of maintaining monopoly power. The challenges posed by GM food technology for developing countries were also noted, and the Danes proposed adoption of a convention that would provide these technologies at no charge to these countries.

This concern about concentration of economic power was also expressed in recommendations by all three panels about independent research and assessment in areas such as risk assessment, the viability and impacts of choosing non-GMO options (Australia), and research on developing countries' needs (Denmark).

Environmental developments considered problematic revolved around the spread of resistance traits to other species, threats to biodiversity, and uncertainties regarding long-term effects. Ethical questions ranged from patenting life forms, respect for cultural, moral, and religious values, and animal welfare.<sup>35</sup>

All three panels took issue with the quality, quantity, and accessibility of information available to consumers. All expressed concerns about labeling, with the Danes and Australians recommending the more stringent approaches: the Danes, for instance, said consumers needed “information as to how gene technology was applied in the production of a product and to what extent.”<sup>36</sup> The Australian panel “reject(s) the use of the term ‘substantial equivalence’ because of its narrow scientific application” and recommended labeling of all GM food. “Such labeling must show the reason for genetic change,” the Australian panel maintained.<sup>37</sup> The Canadian panel recognized that labeling issues had not been resolved and simply proposed that the (soon to be appointed) Canadian Biotechnology Advisory Committee try to develop a more effective labeling policy.<sup>38</sup>

Participatory approaches to regulation were also proposed by all three panels. The Australian panel stated very generally that “government should establish a mechanism similar to the consensus conference, to bring together a body consisting of industry, consumer groups, critics, other experts, and Australian lay people.” The Canadian panel similarly recommended

**Table 1.** Questions on food biotechnology raised in citizen panel reports.**1. Health and Safety**

Denmark: *How does the consumption of GM food affect the human organism?*

Australia: *What constitutes an acceptable risk of introducing GMOs into the food chain?*

Canada: *What are the risks of consuming GM foods in comparison to conventional foods?*

**2. Environment**

Denmark: *What environmental consequences do development and production of GM foods entail?*

Australia: *What are the fundamental issues affecting the environment in relation to GMOs and what are the potential negative impacts of gene technology on living organisms?*

Canada: *What are the environmental impacts of GMOs?*

**3. Economics**

Denmark: *How do we prevent a monopolistic market where few companies control the certainty of food supply, pricing, and quality of GM foods as well as use of gene technology in food production?*

Australia: *Why have multinational corporations been allowed to decide the fate of GMOs in the food chain internationally thus far and what are the dangers of this?*

Canada: *What are the social and economic impacts of genetically engineered food?*

**4. Ethics**

Denmark: *Which values and ethical considerations should form the basis for research, development, and production of gm foods? How can ethical aspects be included in authorization and control procedures for genetic modification of animals, plants for production?*

Australia: *What are the ethical issues involved in altering the fundamental building blocks of life through gene technology including issues of ownership, control, and manipulation?*

Canada: *What ethical considerations govern food biotechnology?*

**5. Regulation and International Trade**

Denmark: *What should be the content of Danish/EU legislation on GM foods regarding responsibility, control, and violations? How do we ensure an independent, competent granting authority over authorization and control of GM foods for testing, production, and cultivation short-term and long-term?*

Australia: *Could you outline which treaties and trade agreements Australia is subject to that affect our ability to make or change our decisions on gene technology in the food chain?*

Canada: *What implications do existing international trade agreements have on food biotechnology decisions made in Canada?*

**6. Public Participation/Information**

Denmark: *How do we ensure that consumers have sufficient information on GM foods?*

Australia: *What information about GMOs should the public be made aware of at all stages of food production from paddock to plate rather than at the point of sale alone?*

Canada: *The 1998 Canadian Biotechnology Strategy states that emphasis on public participation is a key element of the strategy. What kind of process would ensure that on-going public participation is integral to policy development and implementation?*

**7. Nature**

Denmark: *To what extent can production of GM food alter nature's cycle?*

**8. Labeling and Choice**

Australia: *How will consumers be provided with the information necessary to enable them to make a well-informed choice to buy or not to buy GM food?*

**9. Alternatives to Gene Technology**

Australia: *What would happen if Australia said "no" to allowing gene technology, particularly in the areas of agriculture, the environment, and our relationship with other countries that will allow gene technology?*

**10. Benefits**

Denmark: *What do consumers gain from GM food?*

“that public participation be on-going in many different formats.” In the Danish final document, recommendations regarding participation were more specifically linked with the discussion on ethics and the proposal to establish a council on gene ethics. There is probably no significant difference between the attitude of the Danish panel and the panels in the two other countries in this respect. The more narrow focus in the Danish final document likely reflects the situation in Denmark where various participatory arrangements already exist in the biotechnology area.

### *Differences*

As producer–exporter countries, the Australians and Canadians appeared conscious of both trade obligations and constraints by raising this issue. However, despite the fact that this dilemma is also potentially important in Denmark, and clearly reflected in government policies in this area, it is not apparent in the Danish final document. This may be due to the intense public debate over biotechnology in recent years and the broader, and very critical, debate about the consequences of industrialized farming practices in Denmark in the last 10 years.<sup>39</sup>

The issue of alternatives to genetically modified products and the importance of organic agriculture were raised by the Danes and Australians but not by the Canadians. With regard to the Danish discussion, this was much influenced by the organic farmers opposing GMOs in organic agriculture. This was a subject of media attention in 1998, and a representative from the Danish Association of Organic Agriculture was on the Danish expert panel. Likewise, in Australia, organic farming had experienced a pronounced growth in recent years.<sup>40</sup> However, along with this expansion, a new type of organic grower characterized by large-scale farming and export orientation had entered the organic sector. This had given rise to tensions within the group of organic farmers and opened up debates about the future of the organic sector. In this connection, repercussions from the US controversy over a US Department of Agriculture (USDA) proposal for rules of organic farming in the US also affected the Australian debate.<sup>41</sup> The USDAs initial proposal was not to exclude genetically modified food and crops from the “organic” umbrella, a decision that was subsequently withdrawn after an enormous public outcry.

The careful balancing between different considerations was perhaps most clearly demonstrated by the Canadian panel, especially in the following statement taken from its conclusion: “is this a beneficial technology for all of society? Is this a safe technology? Can the use of this technology respect the individuality of humankind? We conclude that the answer is yes, *if we make it so.*” The Australian panel was more straightforward and simply stated, in the face of its quite critical recommendations about science and risk, that “this should in no way affect the current usage of GMO crop cultivation in Australia or any existing use of GMO products.” Finally, the Danish panel took no similar opportunity to support the technology. On the contrary, in its discussion about what consumers gain from genetically modified food, it simply concluded that “apparently, no—or only quite few—direct advantages exist at present. However, the panel does not reject the idea that in the long run, advantages will emerge.”

There were also differences in trust towards regulatory authorities. The Australians rejected the opportunity to hear from government officials, a decision taken at the expert selection stage, the exception being one official from the science and technology research ministry.<sup>42</sup> The Canadian lay panel report, on the other hand, noted that while Canada had some of the highest standards for food safety, the potential for influence on regulatory bodies and the conflict between the government’s promotional versus regulatory roles were sources of concern.

The Danes and Australians specifically juxtaposed the frame of “nature” against the food biotechnology issue, with the Danish panel asking how GM foods “can alter nature’s cycle?”

Although not one of their key questions, the Australians similarly asked, “who advocates for nature?” In Denmark, the inclusion of this theme doubtless reflects a widespread notion of biotechnology as something “unnatural,” as opposed to, for instance, organic farming being in accord with the cycle of nature. It is not clear why the Canadian panel did not make a similar reference. However, survey findings have shown that Canadians are more likely than Europeans, and specifically the Danes, to equate biotechnology with economic competitiveness and to be more accepting of industrial agriculture.<sup>43</sup>

### *Impacts*

As mentioned above, there are several types of impacts of a consensus conference. One type is the direct political influence on decisions taken in Parliament or by the government. None of our three consensus conferences had such impacts. The final document of the Danish conference received comments immediately after it had been presented on the last day of the conference from the head of the parliamentary committee on food, who responded positively to the conclusions and recommendations, but no further impacts have been recorded so far. Regarding the wider social impacts, there was comprehensive press coverage in Denmark, where several of the major newspapers had large feature articles about the conference and the contents of the final document. In this respect, the conference was contributing to the Danish debate about food biotechnologies, as it traditionally often has.

The Canadian lay panel's Final Report was sent to the seven federal ministries overseeing biotechnology regulation. Policy makers who had attended the conference and regulators on the expert panel provided reports to their individual ministries. Project staff made presentations on the process and outcome to various fora including two parliamentary committees. Media coverage was extensive both during and immediately after the conference. A month after the conference, the national public radio network launched a weeklong series on GM food, using two of the citizen panelists among their program sources. Three months later, the flurry of coverage began on the issue of food biotechnology. The link between the citizens' conference and the later media attention is one we cannot make, of course, other than to point out that the citizens' conference became one of the key events at the start of national attention to the issue. The ensuing attention (which included a fair amount of coverage that was negative to GM food) put pressure on federal ministries to put together a committee to create standards for the voluntary labeling of genetically modified and non-genetically modified food.<sup>44</sup>

Perhaps one of the most important outcomes was that one of the citizen panelists was appointed to sit on the new Canadian Biotechnology Advisory Committee, the national advisory body created by the government with a mandate to provide advice on biotechnology policy and to oversee public participation and consultation.<sup>45</sup> This Advisory Body has now begun the process of consulting Canadians and has included the use of a consensus conference among its proposed tools.

The Australian consensus conference was promoted by the Australian Consumers' Association as a way of furthering public discussion and debate on GM food and was also not linked to a specific policy initiative. The Australian Broadcasting Corporation had exclusive access to the lay panel both before and during the conference and created a website that was active throughout the preparatory period until three weeks after the final public conference. The site provided additional information, links to other sources on the subject, and an on-line discussion forum, thereby expanding the scope of the public discussion beyond the conference.

Several policy initiatives were announced a few months after the conference and, given the proximity to the lay panel report, likely had been under discussion beforehand and were not direct outcomes of the panel's recommendations. For example, an Office of Gene Technology

was announced in May 1999 under the Health ministry. This Office was mandated to oversee regulatory issues not covered by existing ministries with biotechnology jurisdiction. The lay panel's report had highlighted the problem of maintaining regulatory oversight within the agriculture ministry, which was considered a conflict of interest, given this ministry's promotion of biotechnology. They recommended an Office of Gene Technology that would be more appropriately housed in the health ministry.

The lay panel also pushed for labeling of all GM foods, a policy which was announced by the Australia–New Zealand Food Authority.<sup>46</sup> The labeling regulation has not yet been implemented pending debate about the scope of such a label (i.e., what to label and threshold standards). All in all, it appears that the Australian consensus conference gave voice to public concerns but also contributed to the push toward a preferred set of policy choices already under consideration.

#### 4. Conclusions

##### *The consensus conference in cross-national perspective*

In analyzing how replicable the Danish consensus conference model is in different contexts, this examination focused on the experiences of two other countries against a Danish counterpart. Our case study suggests that the consensus conference model is one that “travels well” and is easily adapted to contexts outside of Europe. All three countries are, of course, similar as post-industrial liberal democracies with common western cultural foundations. Having said this, it appears our observation still holds when one considers that the model has also been applied in Japan and South Korea.<sup>47</sup>

##### *The case of food biotechnology in international perspective*

The current controversies around the issue of food biotechnology have begun to receive international attention, albeit with varying degrees of concern. While many issues around food tend to be domestic in nature, there are issues that transcend domestic borders, and food biotechnology demonstrates this crossover attribute. The rapid proliferation of recombinant DNA technology, the focus on biotechnology as a national strategic priority for many industrial countries, the move towards free trade economies, and the global nature of food trade (propelled in part by more diverse consumer food tastes and preferences) all ensure that food biotechnology is a local and an international concern.

Concerns about how food is produced and how this production affects larger ecological and social systems suggest the much broader boundaries beyond food consumption within which all three lay panels were interested in framing food biotechnology. It is notable that all three groups found relevant—in fact, insisted on—the importance of these social, political, and economic contexts. What are the impacts of production practices on the third world, on farming communities, and on animal welfare? The focus on ethical concerns in all of the three final documents can be seen as reflecting their opposition to the narrower technical tropes of scientific risk discourse.

Such a discourse, which characterizes the regulatory approach in many industrialized countries and which, despite the above mentioned differences between countries, almost invariably carries the messages that genetically modified food is “unequivocally” safe to eat, is environmentally benign, and comes with a full array of benefits (without mention of uncertainty or risks) was shown by all three panels to be inadequate if not flawed. On the contrary, all three panels discuss risk in broader terms, encompassing uncertainties and unknown effects

as well as potential long-term consequences. Having considered a base of information about this technological application, the panels, to varying degrees, exuded what Beck called “self-confident doubt,” and their skepticism became the base from which they moved to a different vision of this technology in society.<sup>48</sup> What we have, in essence, is a convergence in “frames of meaning” about a technological artifact (in this case, food biotechnology) from groups of lay citizens.<sup>49</sup>

#### *Internationalizing the consensus conference as model for citizen engagement in technology assessment*

What are common in the countries that have employed the consensus conference model are the experience of industrialization and the entrenchment of science and technology in every aspect of life. While inducing beneficial changes, these technologies carry known as well as unanticipated risks whose consequences can sometimes be of an immense order of magnitude. They also raise important ethical and value dilemmas that make the management of such technologies more complex and demanding. Post-industrial values have also shifted in the direction of greater emphasis on quality of life dimensions in contrast to purely economic benefit, and on greater emphasis on access to decision-making fora.<sup>50</sup> The issue of “the quality of democracy” has been a focus of debate in the Netherlands, for example, with an emphasis on problems of legitimating.

The use of such a model of technology assessment, which directly involves lay citizens, has become increasingly common for a number of reasons, not least of which are problems of effectiveness of governance and legitimacy. The shortcomings of the instrumental rationality approach, which undergirds technology assessment, have been detailed elsewhere, and this has led, not surprisingly, to questions of legitimacy.<sup>51</sup> The consensus conference, as a model of deliberative democracy, may be seen as one response to the challenge of making technological decisions more legitimate.<sup>52</sup>

The implementation of consensus conferences, whether it is pushed by governments themselves or by groups interested in furthering technological discussions and broadening the base for decision-making, reflects attempts to grapple with what A. Feenberg called the basic “dilemma of development.”<sup>53</sup> That is, governments that have long relied on a foundation of technical expertise now have to contend with demands for greater participation and more inclusive decision-making. The challenge, however, is that participation and expertise have traditionally been viewed as basically incommensurable.

Consensus conferences and other similar models of public participation can be seen as an attempt to bridge this incommensurability. As lay publics bring in their ways of defining issues, their experiences and their values to these deliberative approaches, such processes “de-monopolize expertise” and recognize that ordinary people are intrinsically part of the technological project.<sup>54</sup> Both traditional science and lay experience on their own have their individual shortcomings. However, these discursive mechanisms attempt to have each learn from the other and in so doing, make the first steps toward designing a technology whose ownership is assumed by the broader polity.

## References

- 1 See, for example, S. Joss and J. Durant, eds., *Public participation in science: the role of consensus conferences in Europe* (London: Science Museum, 1995); I. Mayer and J. Geurts, “Consensus conferences as participatory policy analysis: a methodological contribution to the social management of technology,” in *The social management of genetic engineering*, P. Wheale, R. von Schomburg, and P. Glasner, eds. (Aldershot: Ashgate, 1998).

- 2 S. Joss "Evaluating consensus conferences: necessity or luxury?" in *Public participation in science: the role of consensus conferences*, S. Joss and J. Durant, eds. (London: Science Museum, 1995).
- 3 E. F. Einsiedel was principal investigator for the Canadian research study and served as Project Director. E. Jelsøe has observed a number of consensus conferences in Denmark. T. Breck was previously affiliated with the Danish Board of Technology, where he has been project manager for two consensus conferences, and with the Danish Consumers' Association.
- 4 Mayer and Geurts, "Consensus conferences as participatory policy analysis. . ."
- 5 A. Rip, T. Misa, and J. Schot. "Constructive technology assessment: a new paradigm for managing technology in society," in *Managing technology in society: the approach of constructive technology assessment* (London: Pinter, 1995); See also A. Hamstra, The role of the public in instruments of constructive technology assessment, in *Public participation in science: the role of consensus conferences in Europe*, S. Joss and J. Durant, eds.
- 6 Thus, for instance, the Danish Ministry of Trade and Industry issued two comprehensive reports about technology assessment in the first half of the 1980s.
- 7 E. Jelsøe, "Information's role in the introduction and social regulation of new biotechnologies," in *Between understanding and trust: the public, science, and technology*, M. Dierkes and C. Von Grote, eds. (Reading: Harwood Academic Publishers, 1999).
- 8 L. Klüver, "Consensus Conferences at the Danish Board of Technology," in *Public participation in science: the role of consensus conferences*, S. Joss and J. Durant, eds. (London: Science Museum, 1995); I. E. Andersen and B. Jæger, "Scenario workshops and consensus conferences: towards more democratic decision-making," *Science and Public Policy*, 26, no. 5 (1999): 331–340; S. Joss, "Danish consensus conferences as a model of participatory technology assessment: an impact study of consensus conferences on Danish Parliament and Danish public debate," *Science and Public Policy*, 25, no. 1 (1998): 2–22.
- 9 Joss and Durant, *Public participation in science: the role of consensus conferences*; Mayer and Geurts, "Consensus conferences as participatory policy analysis. . ."; T. Agersnap, "Consensus conferences for technology Assessment," in *Technology and democracy, the use and impact of technology assessment in Europe*, Proceedings of the 3rd European Congress on Technology Assessment, Copenhagen, 4–7 November 1992, 1:45–53; Andersen and Jæger, "Scenario workshops and consensus conferences. . ." *A short description of the consensus conference*: The consensus conference is organized as a dialogue between a panel of lay people and a panel of citizens. In addition there is an advisory/planning committee that is responsible for the process, that "all rules of a democratic, fair and transparent process have been followed" (Andersen and Jæger: p. 333). The conference is open to the public and the media. The Danish conferences, as organized by the Danish Board of Technology, are often attended by members of the Danish Parliament.  
*The citizen panel* is the most important part in the process. The members are interested citizens recruited by advertising or by sending an invitation to a random sample of citizens. Among the people who want to participate the panel is selected by applying criteria of gender, age, education, occupation, and region. Before the conference itself the lay panel is introduced to the topic over two weekends, they select the more specific questions for the conference, and they participate in selecting the experts for the expert panel.  
*The expert panel* typically consists of 12–15 experts within various fields related to the topic in question. They are selected so that different views as well as different professional backgrounds are represented. The panel may consist of scientists, regulators, industrialists, NGO representatives, people concerned with ethics, etc.  
 At the conference, on the first day, the experts make presentations in which they answer the questions posed by the citizen panel. On the second day, the citizen panel can ask questions and discuss with the experts and the audience, too, can ask questions. After that the citizen panel works with the elaboration of the final document. The panel strives to reach consensus on views and recommendations through open discussion. On the third day the final document is presented to the audience, including the media, and the experts. The experts get the opportunity to comment on the document and correct factual misunderstandings but not to change any of the views expressed in it. In Denmark, the document is sent to the Parliament and often a member of the relevant parliamentary committee will comment on the contents of the final document, when it is presented at the last day of the conference (that happened, for instance, at the conference on genetic engineering on food in 1999, where the head of the parliamentary committee on food was present and gave his comments).
- 10 Mayer and Geurts, "Consensus conferences as participatory policy analysis. . ."
- 11 Teknologirådet, Konsensuskonferencer—offentlig debat om ny teknologi. <http://www.tekno.dk/metod/konsda93/konsdan.htm>. September 1, 1999; See also Agersnap, "Consensus conferences for technology Assessment."
- 12 There have been a variety of proposals for evaluating these models of public participation with some similarities among them. See, for example, G. Rowe and L. Frewer, "Public participation methods: a framework for evaluation," *Science, technology and human values*, 25:1 (2000): 3–29; D. Guston, "Evaluating the first US consensus conference: the impact of the citizens' panel on telecommunications and the future of democracy," *Science, technology, and human values*, 24:4 (1999): 451–482; S. Joss, "Evaluating consensus conferences:

- necessity or luxury?" in S. Joss and J. Durant, *Public participation in science: the role of consensus conferences in Europe*.
- 13 Rathenau Institute, Work Programme 1999–2000, The Hague, p. 9.
  - 14 D. Guston, "Evaluating the first US consensus conference: the impact of the citizens' panel on telecommunications and the future of democracy."
  - 15 An overview listing most of the consensus conferences that has been arranged throughout the world since the first conference in Denmark in 1987 is found on the website of the Loka Institute in Massachusetts on <http://www.loka.org/pages/worldpanels.htm>.
  - 16 Ernst and Young, Report to the National Biotechnology Advisory Committee, Ottawa, Canada, July 1997.
  - 17 S. Jasanoff, "Product, process, or programme: three cultures and the regulation of biotechnology," in M. Bauer ed., *Resistance to new technology: nuclear power, information technology, and biotechnology*, (Cambridge: Cambridge University Press, 1995).
  - 18 Canadian Food Inspection Agency Plant Health and Production Division, Variety section, on [www.cfia-acia.agr.ca](http://www.cfia-acia.agr.ca)
  - 19 EU Commission, Genetically modified organisms in food and environment, Joint Research Center on <http://biotech.jrc.it> 1999; Also, Danish Food Administration, personal communication, September 13, 1999.
  - 20 Commonwealth Scientific and Industrial Research Organization, 1999, Gene technology in Australia, on <http://genetech.csiro.au>
  - 21 T. Hoban, "Consumer acceptance of biotechnology: an international perspective," *Nature Biotechnology* 15 (March 1997): 232–234; Also, E. F. Einsiedel, "Biotechnology and the Canadian public: report on a national survey and some international comparisons," Report to the Social Sciences and Humanities Research Council, Calgary, Alberta, 1997.
  - 22 E. Jelsø, J. Lassen, A. Mortensen, H. Frederiksen, and M. Kamara, "Denmark," in *Biotechnology in the public sphere: a European sourcebook*, J. Durant, M. Bauer, and G. Gaskell eds. (London: Science Museum, 1998).
  - 23 Jelsø et al., "Denmark;" Gaskell et al., *Biotechnology in the public sphere: a European sourcebook*; Public perceptions of biotechnology in 1996: Eurobarometer 46:1, in *Biotechnology in the public sphere: A European sourcebook*. J. Durant, M. Bauer, and G. Gaskell, eds. (London: Science Museum, 1996).
  - 24 Einsiedel, "Biotechnology and the Canadian public: report on a national survey and some international comparisons;" Jelsø, "Denmark;" J. Norton, G. Lawrence, and G. Wood, "Australian publics' perceptions of genetically engineered foods," *Australasian Biotechnology* 8, no. 3 (1998): 182–191.
  - 25 J. Toft, "Denmark: seeking a broad-based consensus on gene technology," *Science and Public Policy* 23, no. 3 (1996): 171–174.
  - 26 Toft, "Denmark."
  - 27 The different label was intended to focus attention on the actors rather than the process, as the term "consensus conference" was unfamiliar to Canadians. This was further inspired by the French consensus conference, which also used the "citizens conference" label.
  - 28 D. Powell and W. Leiss, *Mad cows and mother's milk* (Montreal: McGill-Queens University Press, 1997).
  - 29 E. McKay, *First Australian Consensus Conference on Gene Technology in the Food Chain: Evaluation Report, Stage 1* (Canberra, Australia, 1999).
  - 30 C. Renouf, Australian Consumers Association, Personal Communication.
  - 31 G. Lawrence and F. Vanclay, "Gene biotechnology, the state and Australia's agri-food industries," in R. Hindmarsh, G. Lawrence, and J. Norton, eds., *Altered genes, reconstructing nature* (St. Leonard's, Australia: Allen and Unwin, 1998).
  - 32 Hindmarsh, et al., *Altered genes, reconstructing nature*.
  - 33 J. Kelly, Public perceptions of genetic engineering, Report to the Department of Industry, Science and Technology, Australia, 1995.
  - 34 The Danish Consumer Council, founded in 1947, is independent of public authorities and acts as spokesperson for consumer interests in Denmark. It consists of representatives from 26 national organizations and from local consumer groups in Denmark. It is the dominant consumer organization in Denmark even though in recent years some minor and more radical NGO's have emerged, especially in the area of food related issues, including gene technology.
  - 35 Genes for antibiotic resistance are commonly used as markers to identify transformed material. These marker genes are transferred along with the genes coding for the desired attribute and are closely linked to them in the recipient organism. Concerns revolve around the potential transfer of antibiotic resistance to humans. "Terminator technology" refers to the development of crop seeds modified to become sterile after one planting.
  - 36 Consensus Conference on Food Biotechnology: Final Report, Copenhagen, Denmark, March 15, 1999.
  - 37 Consensus Conference on Gene Technology in the Food Chain: Final Report, Canberra, Australia. March 12, 1999.
  - 38 Citizens' Conference on Food Biotechnology: Final Report, Calgary, Canada, March 7, 1999.

- 39 Jelsøe, et al., "Denmark."
- 40 K. Lyons and G. Lawrence, "Institutionalization and resistance: organic agriculture in Australia and New Zealand," Paper presented at the XVIII Congress of the European Society for Rural Sociology, Lund, Sweden, 24–28 August, 1999; See also K. Lyons and G. Lawrence, "Alternative knowledges: organic agriculture and the biotechnology debate," *Culture and agriculture* 21 no. 2 (1999).
- 41 Lyons and Lawrence, "Institutionalization and resistance: organic agriculture in Australia and New Zealand."
- 42 Consensus Conference on Gene Technology in the Food Chain, 1999; McKay, *First Australian Consensus Conference on Gene Technology in the Food Chain: Evaluation Report, Stage 1*.
- 43 In the 1996 Eurobarometer survey, whose questions were replicated in Canada, there are some indications of this transatlantic difference. Consider the following two statements, for example: "Only traditional breeding methods should be used rather than changing the hereditary characteristics of plants and animals through modern biotechnology," 59 percent of Danes agreed with this statement while 42 percent of Canadians agreed. To the statement "We have to accept some degree of risk from modern biotechnology if it enhances the country's economic competitiveness," 30 percent and 61 percent of Danes and Canadians, respectively, agreed. These provide some indication of the cultural differences between the two groups; Einsiedel, "Biotechnology and the Canadian public: report on a national survey and some international comparisons;" and Gaskell, et al., *Biotechnology in the public sphere: a European sourcebook*.
- 44 The Canadian Food Inspection Agency, the Canadian Council of Grocery Distributors, and the Canadian General Standards Board sponsored the committee. Even though the mandate of the committee was to develop standards for voluntary labeling, the fact that this committee was created to re-examine the issue of labeling was indication of public pressure.
- 45 E. F. Einsiedel and D. Eastlick, "Designer Genes at the Dinner Table: An Evaluation of the Canadian Citizens' Conference," Unpublished report, University of Calgary, 1999.
- 46 The government of Australia has also responded to the call for more consumer information by means of brochures distributed through supermarkets, a Gene Technology Information Service which is a toll-free phone line, and websites on gene technology. The government has also started a series of public forums on gene technology. See "Media Release," April 19, 2000 at [www.isr.gov.au](http://www.isr.gov.au)
- 47 Korean Consensus Conference on the Safety and Ethics of Genetically Modified Foods: Citizen Panel Final Report, Soongsil University. Nov. 16, 1998.
- 48 U. Beck, *The reinvention of politics* (Cambridge: Polity Press, 1997): 162.
- 49 J. Grin, and H. van de Graaf, "Technology assessment as learning," *Science, technology, and human values* 21 no. 1 (1996): 72–99.
- 50 R. Inghart, *Modernization and post-modernization: cultural, economic, and political change in 43 societies* (New Jersey: Princeton University Press, 1997).
- 51 J. Dryzek, *Discursive democracy* (New York: Cambridge University Press, 1990); P. De Leon, "Democracy and the policy sciences: aspirations and operations," *Policy Studies Journal* 22 no. 2 (1995): 200–212.
- 52 E. Einsiedel and D. Eastlick, "Consensus conferences as deliberative democracy: a communications perspective," *Science communication*, in press.
- 53 A. Feenberg, *Critical theory of technology* (Oxford: Oxford University Press, 1991): 118.
- 54 U. Beck, *The reinvention of politics*, p. 122.

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