

# UNDERSTANDING THE GLOBAL ENVIRONMENT

*Edited by*

SAMIR DASGUPTA



PEARSON  
Longman

*An imprint of Pearson Education*  
Delhi • Chennai • Chandigarh

*Dedicated to my beloved aunt, Basanti Dasgupta, who  
always inspired my academic spirit and whose loving  
spirit still continues to guide me.*

**Copyright © 2009 Dorling Kindersley (India) Pvt. Ltd.**

This book is sold subject to the condition that it shall not, by way of trade or otherwise, be lent, resold, hired out, or otherwise circulated without the publisher's prior written consent in any form of binding or cover other than that in which it is published and without a similar condition including this condition being imposed on the subsequent purchaser and without limiting the rights under copyright reserved above, no part of this publication may be reproduced, stored in or introduced into a retrieval system, or transmitted in any form or by any means (electronic, mechanical, photocopying, recording or otherwise), without the prior written permission of both the copyright owner and the above-mentioned publisher of this book.

ISBN 978-81-317-1702-8

**First Impression**

Published by Dorling Kindersley (India) Pvt. Ltd., licensees of Pearson Education in South Asia.

Head Office: 482 FIE, Patparganj, Delhi 110 092, India.

Registered Office: 14 Local Shopping Centre, Panchsheel Park, New Delhi 110 017, India.

Typeset by Inosoft Systems, NOIDA

Printed in India by Saurabh Printers Pvt. Ltd.

## CHAPTER 19

GOVERNANCE OF GMOs AND THE CONSTRAINTS FOR  
A REDEFINITION OF THE PUBLIC ARENA IN BRAZIL*Julia S. Guivant*

## INTRODUCTION

Recent developments in science and technology, especially in the field of biotechnology, have brought about new challenges concerning the redefinition of the decision-making process on controversial issues, such as the management of environmental and health risks. In the last decade the demand for turning science more democratic, as opposed to the monopolization of knowledge by experts, and establishing a transparent and empowering debate, has been addressed from the sociology of environment (Irwin 1991, 2001; Wynne 1996a, 1996b), social theory (Beck 1999; Giddens 1991) and the sociology of science (Callon 1998; Callon et al. 2001; Latour 1998; 1999). This confluence towards overcoming dichotomies between laypeople and the experts in innovations involving uncontrollable and uncertain risks started to become stronger in the period before the broad debate over transgenics. Even so proposals would remain diffuse and imprecisely formulated (Guivant 1998, 2001a).

The debate on GMO (genetically modified organism) risks has stimulated in some countries a demand for further debate over what are the forms of risks that societies are willing to take and over how it is to be decided, who should do it, and who will win and who will lose (Nestle 2003). The implementation of several concrete public engagement experiences aimed at defining the public policies about the governance of GMOs, but this situation cannot be generalized. The differences in the national reactions in relation to 'GMOs' possible risks are also a key question. In a recent book, Jasanoff (2005: 5) argues that the 'political reception of biotechnology serves as a window for looking into a number of large contradictions confronting democratic governments in the 21st century'. Still, according to Jasanoff, the

conflicts around GMOs put the scientific field more openly closer to politics. Through a comparative study of how the situation was managed in the United States and some countries in the EU (mainly the UK and Germany), Jasanoff relates the stories of the intimate relationships between the inventiveness in science and technology and the inventiveness in the political arena, in the search for new forms of assessing and regulating the processes and products of genetic engineering. But the stories do not end there for Jasanoff (2005: 6), because she understands that the politics of biotechnology 'serves as a theater for observing democratic politics in motion'. One key concept in her analysis of this theatre is 'political culture' and allows her to avoid focusing on the differences in dealing with science and technology in the national contexts by appealing to national interests, policy priorities, or levels of development. Those differences 'occur despite the leveling effects of protechnology state policies, global movements of knowledge and capital, and the role of transnational actors such as scientists, social movements, and industry' (Jasanoff 2005: 8).

Although there are difficulties in defining the concept of political culture, and others that Jasanoff uses like 'civic epistemologies', in general terms her perspective is quite illuminating for understanding the differences not only among the countries she has studied, but also considering the Brazilian case. While in the USA there was no significant reaction, and in many countries of the EU there was reaction and the search for and implementation of a process of science democratization, and the implementation of the precautionary principle (Godard et al. 2002; Levidow 2001), in Brazil there was reaction, but without democratization. We will argue that this peculiar situation can be explained the Brazilian political culture, with a significant elitist and traditional character, that permeates the action of political parties, social movements and other political actors. The debates took place in a restricted arena, without discussion of how or why it was important to implement new political channels for a legitimate public debate. As we will analyse in this chapter, there was and still can be observed a clear and open confrontation between two different coalitions, for and against the liberalization of GMOs, but for both sides broadening the participation was not an issue.

The Brazilian case will allow us to emphasize the impossibility of generalizing from the experience of more industrialized countries on the politics and governance of GMOs, and the relevance of studying cross-national variations. Even if we are in a risk society, risks are translated in different scientific and political traditions and cultures, and some of these traditions show more resistance than others. My main argument is that the silence about public participation in Brazil and the noises of the confrontation of both coalitions

finally contributed to the strengthening of the standard tradition of science and its conventional relation to policy.

## MODELS OF INNOVATION AND RISK MANAGEMENT

Two opposing models of risk management, with obviously many tones in between, can be built in the intersection of two axes: one concerning the understanding about the audience and the other concerning the conception of science (Joly 2001). The first model is the standard one, where differences between the way risks are perceived by experts and laypeople are attributed to laypeople's irrational attitudes. Such attitudes would be the consequence of cognitive bias, problems when thinking with probabilities, aversion to innovation and risk and so on. Being identified with the positivist model, this model presents a clear separation between facts and values. Scientists are supposed to be objective and neutral about facts, while laypeople would have subjective points of view. Science responds with a praxis that is independent of political, economic and social influences. The confidence on the institutions responsible for risk management is a central part of this model. For this reason, the visibility of problems and doubts is considered as unnecessary, in order to avoid panic among laypeople. A reduced distance between laypeople and expert perceptions is achieved through information diffusion and education. The communication of risks starts to play an important role and occurs in a linear direction, according to what is called 'the deficit model' by risk theories: experts communicate knowledge to laypeople.

The second model adopts a non-positivist view of science and differs from the first by inquiring what conception of science informs the work of experts. Here we are at the territory of the new sociology of science and social studies of science. In this model, science offers a framework that is unavoidably social as well as technical, since in public domains scientific knowledge embodies implicit models or assumptions about the social world, tacit commitments about audiences or user-situations which may then serve as non-negotiated social prescriptions (Irwin and Wynne 1996). Instead of questioning if an innovation with uncontrollable consequences is accepted or not, this approach offers more open questions such as: What problem is addressed by this technical solution? Are there alternatives? Who benefits from this technology? The social-technical differences are not seen as obstacles but as opportunities to explore possible alternatives. The collective interest is not understood as something obvious, but as a product of negotiations, alliances and social conflicts. Techniques are not seen as fatalities or sources of

progress only, but as tools for building a common world. The layperson is not seen as irrational, since value judgments are made at all phases of the risk-management process. This can be seen in the divergences among experts themselves.

Determining the standards of potential risks only through scientific knowledge is a limited approach. Thus, the rules and the grounds for decision making should be reformulated towards opening the debate and the decision process to a broader audience and also acknowledging the ambiguity and the conflicts of social processes as something unavoidable. New spaces of negotiation are considered necessary in order to break the monopoly of the expert knowledge.

## WHAT IS PUBLIC PARTICIPATION?

In order to understand better the second model and its proposal of public participation it is relevant to reflect on its multiple meanings. At a general level public participation can be defined 'as a practice of consulting and involving members of the public in the agenda-setting, decision-making, and policy-forming activities of organizations or institutions responsible for policy development.' (Rowe and Frewer 2004). At the lowest level, involvement can imply merely the communication of information to the public. And this will be done also in the standard model. At higher levels different methods (with dialogue and two-way communication) can be included, such as consultation exercises, focus groups, and questionnaires (see Tables 19.1 and 19.2), being some more formalized than others.

Among some of the proponents of strategies for a more consistent involvement of the public are recent legislation in countries such as the USA, France and the UK, that has made it necessary to gain public input before decision making in areas of uncertainty (Green Alliance 2000; Grove-White 1999; Grove-White et al. 1997, 2000, Rowe and Frewer 2000; Stirling and Grove-White 1999).<sup>1</sup>

There is no single method that is completely satisfactory. The best method to apply may depend on different factors, and can change in different stages of the decision process and these should be evaluated by sponsors and authorities. A dilemma is how to evaluate the effectiveness of any of the methods in different contexts and situations. Still there are little systematic considerations of this issue in the academic literature, mainly oriented towards procedural aspects of the implementation of these methods than substantive evaluations (Rowe and Frewer 2000).

It is also necessary to avoid appealing to participatory methods in relation to any public issue. Its main contribution is related to value-based and controversial decisions and is not in technical questions where simple disagreements can be present. Pellizzoni (2003) differentiated these positions as follows:

The latter can be resolved by appealing to 'facts'—that is, by using shareable kinds of rational argument referred to scientific research, witnesses, past experience, and so on. The former cannot. In this case, the parties in dispute tend to emphasize different facts, or give them different interpretations, so that each party seeks to confute the empirical evidence adduced by the others. There is no consensus either on the relevant knowledge or on the principles at stake. Facts and values overlap.

Here emerges a basic problem: From the point of view of the standard model values are excluded as a possibility from the experts' point of view. Only assuming presuppositions related to the non-positivistic model, values can be recognized as a base for negotiation among different social actors with different interests. In this approach citizen and consumer groups can be respected in an independent perspective, with a reduced role and influence of industry. Of course, assuming this alternative raises new problems and related questions as well in relation to NGOs, that deserve more investigation in order to guarantee the independence (this is not the same as neutrality) of the process. MacGregor (2003), explaining an interesting initiative assumed by Health Canada in order to learn from citizen groups in other countries about the nature and degree of transparency related to food and health products,<sup>2</sup> mentioned some of these questions:

What does it mean that ... representatives [of the consumers] seem to be more concerned with making sure government lets them have a seat at the table than they are with making recommendations on how to be sure they have influence at the policy table? Does their strong focus on improving the process so that it is more visible, inclusive, accountable and accessible preclude their ability to focus on advocating public education about health issues? Would not a more informed public make their 'job' easier relative to influencing the policy process for food and health product review?

In the following section I will analyse how in Brazil the debate in relation to GMOs started and continues to take place with a non-significant explicit, public or legitimate discussion about how the decision process facing such a polemical issue be conducted.

**Table 19.1: A Number of the Most Formalized Public Participation Methods**

<i>Participation Method</i>	<i>Nature of Participants</i>	<i>Time Scale/Duration</i>	<i>Characteristics/Mechanism</i>	<i>Examples/References</i>
Referenda	Potentially all members of national or local population; realistically, a significant proportion of these.	Vote cast at single point in time.	Vote is usually choice of one of two options. All participants have equal influence. Final outcome is binding.	Biotechnology in Switzerland (Buchmann 1995); waste repository in Sweden.
Public hearings/inquiries	Interested citizens, limited in number by size of venue. True participants are experts and politicians making presentations.	May last many weeks/months, even years. Usually held during weekdays/working hours.	Entails presentations by agencies regarding plans in open forum. Public may voice opinions but have no direct impact on recommendation.	Frequently mechanism in, for example, United States (Florino 1990), Australia (Davison, Barnes, and Schibeci 1997); review by Middendorf and Busch (1997).
Public opinion surveys	Large sample (e.g., 100s or 1,000s), usually representative of the population segments of interest.	Single event usually lasting no more than several minutes.	Often enacted through written questionnaire or telephone survey. May involve variety of questions. Used for information gathering.	Radioactive sites in United States (Feldman and Hanahan 1996); genetically modified food in the United Kingdom (Vidal 1998); biotech surveys (Davison, Barnes, and Schibeci 1997).
Negotiated rule making	Small number of representatives of stakeholder groups (may include public representatives).	Uncertain: strict deadline usually set day/weeks/months.	Working committee of stakeholder representatives (and from sponsor). Consensus required on specific question (usually, a regulation).	Used by US Environmental Protection Agency (Hanson 1984); method discussed by Susskind and McMahon (1985) and Florino (1990).

(Table 19.1 Contd.)

(Table 19.1 Contd.)

<i>Participation Method</i>	<i>Nature of Participants</i>	<i>Time Scale/Duration</i>	<i>Characteristics/Mechanism</i>	<i>Examples/References</i>
Consensus conference	Generally, 10 to 16 members of public (with no knowledge on topic) selected by steering committee as 'representative' of the general public.	Preparatory demonstrations and lectures (etc.) to inform panelists about topic, then three-day conference.	Lay panel with independent facilitator questions expert witnesses chosen by stakeholder panel. Meetings open to wider public. Conclusions on key questions made via report or press conference.	Used in Denmark and Netherlands on topics from food irradiation to air pollution (Joss and Durant 1994; Grundahl 1995); also used in United Kingdom on plant biotechnology (Ellahi 1995).
Citizens' jury/panel	Generally, 12 to 20 members of public selected by stakeholder panel to be roughly representative of the local population.	Not precise but generally involve meetings over a few days (e.g., four to 10).	Lay panel with independent facilitator questions expert witnesses chosen by stakeholder panel. Meetings not generally open. Conclusions on key questions made via report or press conference. and Mitchell 1996).	Examples in Germany, United States, and United Kingdom (e.g., Crosby, Kelly, and Schaefer 1986; Coote, Kendall, and Stewart 1994; Lenaghan, New
Citizen/public advisory committee	Small group selected by sponsor to represent views of various groups or communities (may not comprise members of true public).	Takes place over an extended period of time.	Group convened by sponsor to examine some significant issue. Interaction with industry representatives.	Particularly evident in United States, for example, in cleanup of waste sites (Lynn and Busenberg 1995; Perthac 1998); see Creighton (1993) for guidelines.
Focus groups	Small group of five to 12 selected to be representative of public, several groups may be used for one project (comprising members of subgroups)	Single meeting, usually up to two hours.	Free discussion on general topic with videotape recording and little input/direction from facilitator. Used to assess opinions/attitudes.	Guidelines from Morgan (1993); UK example to assess food risk (Fire-Schaw and Rowe 1995).

Source: Rowe and Frewer 2000.

**Table 19.2: An Assessment of the Most Formalized Public Participation Techniques According to Variety of Evaluation Criteria**

	<i>Referenda</i>	<i>Public Hearing</i>	<i>Public Opinion Survey</i>	<i>Negotiated Rule Making</i>	<i>Consensus Conference</i>	<i>Citizens' Jury/Panel</i>	<i>Citizen Advisory Committee</i>	<i>Focus Groups</i>
Acceptance criteria								
Representativeness of participants	High (assuming full turnout at pool)	Low	Generally high	Low	Moderate (limited by small sample)	Moderate (limited by small sample)	Moderate to low	Moderate (limited by small sample)
Independence of true participants	High	Generally low	High	Moderate	High	High	Moderate (often relation to sponsor)	High
Early involvement?	Variable	Variable	Potentially high	Variable	Potentially high	Potentially high	Potentially high	Potentially high
Influence on final policy	High	Moderate	Indirect and difficult to determine	High	Variable but not guaranteed	Variable but not guaranteed	Variable but not guaranteed	Liabile to be indirect
Transparency of process to the public	High	Moderate	Moderate	Low	High	Moderate	Variable but often low	Low
Resource accessibility	Low	Low	Low	High	High	High	Variable	Low
Task definition	High	moderate	Low	High	Generally high	Generally high	Variable but may be high	Variable but may be high
Structured decision making	Low	Low	Low	Moderate	Moderate (influence of facilitator)	Potentially high	Variable (influence of facilitator)	Low
Cost-effectiveness	Variable/low	Low	Potentially high	Potentially high	Moderate to high	Moderate to high	Variable	Potentially high

Source: Rowe and Frewer 2000.

## THE PROLIFERATION OF THE SOCIAL CONDITIONS

In Brazil, the law 8.974 (from January 1995) and the decreto 1.752/95 established the rules for the activities related with GMOs, including the requirements for experimentation and the environmental liberation of them. The Brazilian regulatory system is quite similar to the European one, because it considers the control of this new technology in a different way than other technological innovations. Meanwhile, in relation to the process of inspection, Brazil follows the American model, where each authorization is followed by a local verification, to ensure that the control measures of risk presented by the request parts are being obeyed.

In accordance with the law 8.974, in 1995 the National Technical Committee on Biosafety (CTNBio) was created with a link to the Ministry of Science and Technology, as the main with a governmental organism to deal with GMOs. Initially it was formed by scientists, representatives from the industrial sector and from consumer organizations. But consumer representatives soon abandoned the Committee, because of serious disagreement about how the decision process was conducted.

In 1998, the first GMO agricultural product received a favourable vote from the CTNBio. It liberated the commercialization of Monsanto's Round up Ready (RR). From this point, the stage of the debate was transferred to the judicial arena, main focus of confrontation between the coalitions in favour and against this liberation. The Instituto de Defesa dos Direitos do Consumidor (IDEC—Consumer's Rights Institute) presented a temporary injunction to suspend the authorization for the planting of RR soybean and commercialization without any environmental impact assessment or study (EIA/RIMA).

From 1998, GMOs were placed at the core of a national debate, following developments that were taking place, especially in Europe, involving NGOs, political parties, social movements, scientists, industry and rural productive sectors' representatives, among others.

The conflict occurred mainly in the judicial arena, starting with the IDEC initiative of seeking a temporary injunction against the CTNBio's decision of liberating the first agricultural GMO, Monsanto's Round up Ready Soybean. This is when the conflict entered the legal arena with a particular issue taking the central position and permeating the debate still today: Who decides on the liberation and commercialization of GMOs and if there is a need for Environmental Impact Assessments and Reports and for regulating the food safety issues for this type of product.

This period is characterized by two kinds of coalition, those in favour of and those against the GMOs liberation. For that reason, such a moment can

be identified as a period of proliferation of social organization. The sectors in favour of or against GMOs began to get highly organized, including both laypeople—such as rural productive sectors—and experts; the issue seemed to have a weak appeal to consumers though. Each of those alliances presents a mixed character, not only because they include laypeople and experts, but especially because they bring together social activists with diverse political agendas. In their turn, such alliances articulated with other alliances on the international level, although this does not mean the identification of different themes or the same understanding about the risks involved (Givant 2001, 2002a, 2002b). The media also opened a significant space for the debates occurring between such alliances.

## THE COALITION AGAINST LIBERATION

Since 1998, IDEC actions became stronger because of the alliance established with Greenpeace and other NGOs, political parties such as PT, the Brazilian Society for the Progress of Science (SBPC), the Federal Public Ministry, Brazilian Environment and Renewable Natural Resources Institute (IBAMA) and Consumers Right State Program (PROCON), the Landless Movement (MST) and representatives of indigenous groups. Those social groups and public institutions began to disseminate in the media, in debates, demonstrations, etc., that the risks of using GMOs are widely unknown, pressuring for great caution before any liberation of transgenic products (<http://www.consumidorsa.org.br>).

Inside this heterogeneous alliance against transgenic products we can find 'conventional' social actors, such as The Laborers Party (PT), The Landless Movement (MST) and The National Confederation of Agricultural Laborers (Contag). They incorporated the transgenic issue into their class discourse against globalization, imperialism, multinationals, the United States, IMF, etc. Denunciation of GMOs is justified by economic and political arguments: who benefits and who loses? How can we defend the survival of small farmers and recently settled landless people against globalization and socially excluding markets? For the MST, the use of GMOs in Brazilian agriculture is fundamentally an issue of economic domination, of multinationals and big farmers dominating the small farmers, whose autonomy must be protected. Such companies would supposedly dominate the production process involving transgenic's technology, from the acquisition of seeds through to the agricultural processing industry. Large monopolies would be formed, generating a thorough process of domination by multinationals, which would place small

farmers in a situation of total dependency and misery. GMOs are not even important in the fight against world hunger, because this does not depend on the development of genetically modified grains technology, since it is understood to be a socio-political rather than a technological problem.

Crystallizing the coalition, in 1999 they released the 'Campaign for a Brazil Free of GMOs', an initiative of Action Aid Brazil, bringing together Ágora, AS-PTA, Ipê Ecologic Center, Esplar, Fase, Ibase, Inesc, Idec, Greenpeace Brazil, Sinpaf and Brazilian Forum for Food and Nutritional Security reaching 82 NGOs. Their central purpose was to enhance public awareness about the risks GMOs may pose to human health and the environment, as well as informing the population of the threat of seeds monopolies, posed by the strength and marketing muscle of large multinational companies, to small farmers (<http://www.actionaid.org.br/p/campaigns/foodsec.htm>).<sup>3</sup>

Some judges and attorneys have been direct allies in legal disputes brought forward by IDEC and supported by Greenpeace. They are those who adhere to the precautionary principle, together with the Brazilian Society of Environmental Law (Sobradima). Some government bodies have been supporting and strengthening IDEC's position, directly or indirectly. Regarding the need for Environmental Assessment (EIA/RIMA) prior to transgenic soybean liberation, for instance, the Brazilian Environment and Natural Renewable Resources Institute (IBAMA) and the National Environment Council (Conama) instigated a lawsuit against the Brazilian State.

Scientists appear clearly divided into their positions. In the first stages of the conflict, the Brazilian Society for the Progress of Science manifested itself in defence of the precautionary principle, maintaining a very moderate position however. Glaci Zancan, SBPC's President at the time, published the article "O desafio das plantas geneticamente modificadas" (The Challenge of Genetically Modified Plants) in *Cadernos de Ciência e Tecnologia* (EMBRAPA). She affirmed that: 'because of the advantages that transgenic plants research may bring, this technology will be incorporated in our everyday life'. Whenever the obtained products are grown in large scale or liberated for consumption, the risk analyses must assure minimum risk, employing for this purpose the most recent and reliable techniques.

### THE COALITION FAVOURABLE TO LIBERATION

We can find primarily three sectors in this coalition: scientists who defend the criteria and decisions of CTNBio, biotechnology company representatives, such as those of Monsanto, and farmers associations. Since 2002,

representatives of the Lula Government's Ministry have begun to integrate with this coalition actively.

Representatives of companies, fundamentally of Monsanto, remained away from the agitation of the debates: Those who openly assume their positions are above all researchers. Their argument has an orthodox scientific character, identifying the groups taking contrary positions as unreasonable, uninformed, catastrophist and against progress. They claim that criticism against GMOs 'is not based on actual facts. The risk assessments of GMOs and their derivatives, and still other scientific studies, establish that there is no risk involved in their production or consumption'.<sup>4</sup>

Scientists also use an environmental argument, like scientists in other countries, when they say that GMOs reduce significantly the use of herbicides and may be the key for promoting richer wildlife and more efficient food production. Observing the above mentioned, the Brazilian Academy of Science signed in 1998 a document together with seven other international institutions lead by the Royal Society (UK). The document 'Genetically Modified Plants for Human Consumption and Human Safety' concluded mainly that 'there is no scientific evidence that genetically modified products so far approved for human consumption can be harmful to human health'.

The Brazilian Agricultural and Animal Husbandry Research Company (EMBRAPA), for instance, categorizes the transgenic plants issue in four dimensions: the relevance of recombining DNA technology for the sustainable development of Brazilian agriculture; assurance that such technologies will be made safely available for consumers and the environment, under the light of existing scientific and biosafety knowledge available to date; the possible commercial advantage to be obtained from the certification of origin of some transgenic commodities and the right consumers have to choose non-transgenic alimentary products (<http://www.comciencia.br>, 2002).

In 1997, EMBRAPA signed a technical cooperation contract with Monsanto, obtaining the legal support necessary to carry out research into gene and gene-building efficiency evaluation of glyphosate (herbicide) resistant soybeans. EMBRAPA'S official justification was that, while society remains undecided over whether or not it approves GMOs, Brazil ought to deepen its knowledge on the subject to avoid becoming dependent on foreign technologies. However, even within EMBRAPA itself there is no consensual acceptance of GMOs among scientists.

The farmers are decisive actors in this coalition. One of the main characteristics of the Brazilian situation at that moment was the proliferation of clandestine farming of GMO soybeans in the state of Rio Grande do Sul (paradoxically under a PT administration), starting to be more intense since

2000. The seeds were coming from Argentina, with the tolerance of border agents, and the support of farmers associations and farmers themselves.

This coalition was strongly reinforced by media agents. Nevertheless, the role of such agents did not impact the debate—neither favourably nor unfavourably. This, together with the low importance of the supermarket sector's role, demonstrates the significant difference that exists between the Brazilian and the European debate contexts.

As well as PT government's sectors, other political parties such as PPS (Socialist Popular Party), PMDB (Brazilian Democratic Movement Party) joined this coalition. The pro-transgenic groups inside the government set as a goal the end of the Ministry of the Environment's veto power over CTNBio decisions. Farmers and seed producers' associations and scientists were very active in lobbying for the pro-GMOs coalition, which helped Monsanto to keep away from the debate. Pressure from the following organizations was also very intense: Rio Grande do Sul State Agriculture Federation (Farsul), National Agriculture Confederation Credit Commission (CNA), diverse agribusiness representative organizations (Brazilian Agriculture and Animal Husbandry Confederation, National Plant Security Association, Brazilian Seed and Seedlings Association, Brazilian Cooperatives Association, Brazilian Agribusiness Association, Cotton Growers Association, Aviculture Brazilian League, Soybean Growers Association, Brazilian Association of Vegetable Growers Brazilian Seed Technology Association, Brazilian Association of Seed and Seedlings Commercialization and Rio Grande do Sul's Apple Growers Association).

Scientists also mobilized themselves intensely in the period the Law Project was being debated in the Deputies Chambers and Senate. Thirteen scientific societies forwarded, in February 2004, a letter to Senators claiming that CTNBio 'should be the only and definitive body to judge about the scientific nature of such a complex matter'. The societies were as follows (among others): National Security Agency, Brazilian Academy of Sciences, Brazilian Biotechnology Association, Center of Human Genome Studies, Brazilian Center for Gene Storage, Brazilian Food and Nutrition Society, Brazilian Society of Food Science and Technology (*Carta ao Senado/Letter to the Senate*, in *Ciência Hoje*, April 2004).

### THE CONFLICTS INSIDE THE COALITIONS AND CONSEQUENCES FOR THE GOVERNANCE OF GMOs

From 2002 on, the debate began to develop fundamentally in the government arena, but still taking a significant space at the judicial instances. The PT won

the presidential elections in that year with a platform that included the acceptance of the moratoria and the precautionary principle. Also it should be remembered that the PT in many states joined actively the coalition against the liberalization of GMOs. But, once in power, in 2003, the situation changed radically, although slowly, taking by surprise the allies in the coalition.

The first provisory measure the PT government formulated (Medida Provisória—MP-113), on 26 March 2003 (Law n. 10.688 in 13/06/2003), was a direct result of the intensive pressures of farmers associations, scientists and politicians—from the PPS (Partido Popular Socialista) and PMDB (Partido do Movimento Democrático Brasileiro), among others. This MP accepted the crop of the illegal growing transgenic soybeans and its internal commercialization and consumption as well as its exportation.

The coalition against the liberalization reacted with criticism to this MP ([www.actionaid.org.br/p/newsandserv/updates.htm](http://www.actionaid.org.br/p/newsandserv/updates.htm) 10 May 2004). The NGOs intended to question the liberalization of GMOs without real knowledge of the amount of soybeans contaminated by GMOs. IDEC and Action Aid pointed out concerns about public health. To IDEC, the Provisional Measure broke the consumers' code because it placed economic interests above the population's health. Also, in a document directed to the president, subscribed to by more than 80 scientists, most of them agronomists and biologists, researchers called for the revocation of that Provisional Measure. Even sectors favourable to GMOs, such as the CNA (National Agriculture Confederation) questioned the impossibility of certifying all Brazilian soybean crops in order to verify the presence of GMOs, such as is provided for by the Provisional Measure that liberates the marketing of transgenic soybeans. According to CNA studies, the small number of certifying agencies enabled to carry out this kind of analysis and the paper work generated by this new legal requirement would restrain soybean marketing, not to mention the fact that it would force prices down and increase farming costs (*Folha de São Paulo*, 23 March 2003).

Anyway, according with members of this coalition (in personal interviews), the impression was to consider this as an exception in the action and policy of the government and that no serious consequences would be followed. And the polarization inside the government, between the Ministry of Environment and the Ministry of Agriculture, was also softened.

It did not take too long for the crack inside the coalition to become more evident. The government announced another MP, no. 131, on 25 September 2003 (Law 10.8144 in 15/12/2003), authorizing now the right of planting of transgenic soybeans to those farmers that had planted and cropped them in the previous year. The argument was that there were not enough GMO-free

seeds to plant. Now the reaction of the NGOs was strong, with different arguments. One was related to the liberalization of the use of glyphosate.<sup>5</sup> This herbicide was allowed to be used only before planting the area. However, the GMO soybeans need this herbicide after its growing. On 3 October 2003 IDEC took legal action against the Ministry of Agriculture to prohibit the use of glyphosate. This action did not stop the legalization of its use by ANVISA (the national agency of sanitary control), that allowed to increase the level of tolerance of residues 50 times (in accordance with the Chief of the Section of Fiscalização do Receituário Agrônômico, Reinaldo Onofre Skalisz). Until 2003 Anvisa recommended as a limit the presence of 0.2 mg/kg of glyphosate in soybean seeds. From that moment on the maximum to be accepted become 10 mg/kg.

In the face of initiatives to legalize what was illegal, the conflict became more evident inside the government (between ministries) and inside the coalition against the legalization and the government and Congress sectors. And so the coalition suffered an unpredictable (from their point of view) defeat, losing one of its more influential and powerful allies. The PT discourse changed assuming open positions in favour of the liberalization of GMOs. One remaining ally was the Minister of the Environment, Marina Silva, a symbolic representative of the environmental movement. But her position was becoming more and more isolated, although she resisted resigning. As well, the PT confluence with the other coalition become more clear in the negotiations that took place in the Congress at the end of 2003, during 2004 and 2005.

When the MPs were enacted, the 'Pro' coalition became stronger but also started a new conflict. Monsanto assumed a more open position in relation to the payment of royalties. As a matter of fact, the defence of GMOs was mainly assumed publicly by scientists, farmers and politicians. The change in Monsanto position was due to one item of the provisory measures approved by Lula's government that demanded a Term of Responsibility signed by farmers to pay royalties to Monsanto. While on one hand it was taken as a fact of illegal plantation of transgenic soybeans, on the other hand, this meant the end of the other side of the situation: royalties now needed to be paid.

An unpremeditated consequences of the Term was the increase in the commercialization of illegal seeds, something banned in the provisory measure (MP 131). This situation was denounced by the president of Abrasem (Brazilian Association of the Seed Producers) Iwao Miyamoto, for whom the provisory measure was a disaster as it was opening up space for more clandestine seeds.

There was another issue between Monsanto and farmers. The Term of Responsibility signed by farmers to pay royalties to Monsanto was expected

to treat farmers who would not assume responsibility and would continue to clandestinely plant transgenic soybean. In that case, if discovered, they would have their crop destroyed and also would not be able to received credits from official banks.

But the enforcement of this control was very difficult. The Ministry of Agriculture, responsible for the enforcement, did not have enough personnel to do the job. They had 2,700 officials in all the country. Considering only Rio Grande do Sul, there were at that moment more than 150,000 farms of less than 50 hectares each.

Many meetings between Monsanto and representatives of the Federation of farmers of Rio Grande do Sul (the state where transgenic soybeans was more important) took place to negotiate the Term. Monsanto wanted R\$ 1 (around 0,3 \$ US) for each sac of soybeans. But the farmers argued that they would pay only when the modified seeds were legally bought for production. It needs to be remembered that Monsanto wanted to receive royalties for a crop that was grown with seeds illegally commercialized. Another threat that Monsanto (in words of its president in Brazil, Richard Greubel) used was to denounce as 'pirate crops' the ones that did not pay royalties and were for export.

A central part of the debate was around the approval of the Biosafety Law Project. But the scenario was not still completely easy for the coalition in favour of GMOs. Marina Silva won a partial victory with the approval of the Biosafety Project by the Deputies' Chamber in March 2004. Another important aspect of this Project was that it assured support to GMOs' scientific research, field experiments included. The Law Project also determined that regulations and licenses for experimental crop commercialization should observe the principle of maximum precaution and evaluation of national economic interests, food security and environmental impacts, as provided for in the national legislation and in accordance with current international agreements.

Returning now to the situation in the 'in favour' coalition, it strengthened its pressure in the next legal step: the Senate. Here the defeat was complete for Marina Silva and her allies, with the approval on 6 October 2004, of the Biosafety Law substitute, which concentrates the decision power on CNTBio, with 53 votes for, two against and three abstentions. According to this project, CTNBio will have 27 members and will decide over transgenic's research matters. In case other governmental agencies (Ibama or Anvisa) disagree with CTNBio's decision, the latter will only be able to appeal at the CNBS (National Biosafety Council), composed of 11 ministries who will judge the conflict. Regarding the commercialization of GMOs, the Committee can

establish some definitions, but the last decision should be the Ministry Council's responsibility; verdicts are to be arrived at by the majority of six members. That means the Ministry of the Environment and Public Health will not have power of veto over CTNBio's decisions, such as the commercial liberation of GMOs.

The main criticisms from NGOs when the Senate approved the Law Project concerned the role of CTNBio, set to become the supreme body responsible for decisions regarding GMOs. Greenpeace and IDEC agree that CTNBio has an important technical and consultative role to play. However, it should not have the last word about GMOs, since it does not perform all the analyses or studies necessary to understand the interaction of these organisms with the environment and human health. In addition, CTNBio is only a committee attached to the Ministry of Science and Technology, which, in turn, does not have technical or legal competence to supervise public health and environmental issues. This is a function of controlling bodies of the Ministry of Public Health and the Environment.

Because of changes made by the Senate on the text approved by the Deputies Chamber, it returned to this for new voting. The result was its victory and the final approval of the Senate proposal. One of the promises of the government after the approval of the proposal was to carry a broad and transparent consultation of the civic society, to incorporate suggestions. But nothing of this took place, although the criticism of the coalition of NGOs.<sup>6</sup> After eight months, President Lula approved the Decret 5.591 that would regulate the Biosafety Law.

### EVALUATING THE AGENDAS OF THE COALITIONS AND THEIR RELATION TO CIVIC EPISTEMOLOGY

The coalition against GMOs has mainly adopted an internationally defined agenda, based on some selected actions developed by social movements in the European Union. This agenda contains the precautionary principle,<sup>7</sup> the necessity for assessing environmental impacts and for labelling. In some documents and actions it was mentioned the need for public participation, but it was difficult to find what precisely this meant.

Briefly we can say that in the European debate the participation issue is central, implying a reassessment of the ways in which science is planned and interpreted, a very legitimate theme for national governments, groups of scientists, business sectors and the European Parliament. In addition, the awareness among consumers increased and they started to mistrust transgenic

products. This happened mostly due to accumulated information about other food risks that were in reality out of control and had previously been denied by authorities.

In Brazil the superficial appeal to public participation needs to be grounded in the specific civic epistemology that permeates the perception of science on the public among different crucial social actors. As Jasanoff (2005: 250) defines, civic epistemology relates to 'how knowledge comes to be perceived as reliable in political settings and how scientific claims, more specifically, patterns, as authoritative. Put differently, civic epistemology conceptualizes the credibility of science in contemporary political life as a phenomenon to be explained, not to be taken for granted.' In terms of hypothesis, I can state that in Brazil scientific knowledge is much more reliable among the public than among politicians who are seen as inefficient and also corrupt.

On the side of scientific knowledge, not only does the public have a strong consideration of scientific neutrality (*need to quote some data*) but even members of the coalition against GMOs have used the same scientific parameters as the other coalition to legitimize their own arguments: number of publications in scientific journals, need to inform the public in a neutral way and so on. And still the accusations against the other coalition used the argument that they were not truly scientific. Each coalition was blaming the other as 'ideological'. So, there was no discussion about different ways of applying science, and its relation to politics.

Let's take as an example the area of labelling GMOs to understand the consequences of the chaotic attitude of the government agencies in relation to public health, and why the public has this type of fundamental mistrust. Although the decree-law 4.680/2003 provides for the labelling of any product with contamination index higher than 1 per cent (meat, milk and eggs included), as well as the traceability of such products, these measures have not been implemented. The industry was given time until April 2004 to adopt and include a yellow triangle with a 'T' on packages of those products containing more than 1 per cent of GMOs. Those modifications never happened and it did not attract any kind of legal sanction. The Brazilian Association of the Food Industry (ABIA), an ally of the coalition favourable to GMOs, acknowledged that no adaptation of packaging has happened. Apart from such opposing positions, there is a practical impossibility of separating and identifying such products. The National Sanitary Surveillance Office (Anvisa) admitted that it does not have laboratories appropriately equipped to assess the amount of transgenic elements in each product.

Labelling is a basic consumer right and there is no doubt about it. But what is the meaning of labelling for Brazilian consumers? It is important to

understand what the limitations in the control of alimentary risks in the country mean to consumers. It is not only the failure to implement the above-mentioned legislation that defines the Brazilian context. There are other issues directly related to food safety that are not being addressed. As a reminder of just a few important public health deficiencies we can mention the intensive and unmonitored use of pesticides and the commercialization of clandestine meat (Felício 2001). Not to mention medical and other problems. Obviously, the Consumers' Code has introduced huge transformations into the consumers' quality of life, also increasing their expectations and demands (Sorj 2000). The increase in organic food consumption is a quite promising example of this trend (Guivant 2003). The demand for labelling is a part of the consumers' empowerment process. The remaining assumption is that of the 'rational-economic-man' model, by which the consumer is sovereign, making his/her consumption decisions according to precise information, which they believe in, research about and decide on.

Can labelling reflect a valid knowledge and the actual risks? How can we affirm this if we do not really know the risks? Klintman (2002), researching the epistemological grounds of arguments around the GMOs labelling issue, points to the contradictions existing inside the international coalition against GMOs, between a model of science that assumes an epistemological relativism and a standard model that presupposes an epistemological realism.

How can Brazilian consumers position themselves in the face of such matters? What is the level of ontological insecurity, to use Giddens concept, that such risk management brings into people's everyday life? I have been working on other papers dealing fundamentally with issues such as the proliferation of risks, the lack of knowledge about them and, above all, the lack of control over them; a widely generalized attitude is that of adapting to risks instead of inquiring about them. Very little is known about what consumers' perceptions are. In this regard the lack of research on people's perception of science is quite relevant, being a kind of non-problem in Brazil. It is apparent that NGOs, policy makers and scientists are not inquiring about the role of citizens in the decision-making process concerning controversial scientific and technological innovations (Guivant 2002). This scenario contrasts sharply with the relevance that research on new technologies, their evaluation, scientific policies, the economy of technological transformation and so on have assumed in the last decades in Europe and in the United States, with particular consideration to GMOs. Research on public opinion seeks to investigate the acceptance or rejection demonstrated by consumers of new technologies, because of the direct implications the use of these technologies may have over their expectations and beliefs. Besides the more independent

academic research, there are those ordered by the industrial sector or by governmental bodies and NGOs.

The three surveys undertaken by Instituto Brasileiro de Opinião Pública e Estatística (IBOPE) for Greenpeace are among the few research initiatives carried out in Brazil; they are rather superficial though. IBOPE has also carried out one survey for Monsanto. It is important to highlight the innovative research about people's perception of science, undertaken in 2002/2003 in Argentina, Brazil, Spain and Uruguay (Revista Pesquisa, Fapesp, No. 95, 2004). Its methodology, theoretical grounding and objectives deserve special attention.

Returning here to the issue of public participation, even though the need for public debate about GMOs has been mentioned, a higher priority item is still missing on the agenda: that which refers to how such debate ought to be carried out, how to legitimize the participation spaces and how to choose the best strategies to accomplish this task. This reinforces the traditional scientific model, which excludes precisely the possibility of institutionalizing the discussions about how the public debate ought to be.

Consider the most prominent actions of the campaign for the organization of citizen's panels. The first one, called Brazilian Popular Jury on GMOs, took place in Fortaleza (CE), in April 2001. Action Aid and Esplar coordinated the jury. It was composed of 11 small farmers and consumers and reproduced the dynamics of a real judgement to evaluate the impacts of GMOs over human health and the environment in Brazil. The jury condemned the GMOs by complete agreement. To come to a verdict, the Citizens' Jury analysed six matters based on the testimony of 12 witnesses (Monsanto was summoned but did not attend the jury): the hunger problem in Brazil and around the world; access to food and to food safety; the existence of enough scientific evidence to show that GMOs are safe to human health and to the environment; the issuing of opinion regarding the liberation of GMOs for commercialization, with the participation of civil society; and providing farmers and consumers with sufficient information to make sound decisions. In the verdict, the juries advised that workers not use GMOs and that organic farming was to be encouraged; incentives should be offered to encourage family farms.

The same model was applied in September 2001 for the second Citizens Panel on GMOs, undertaken in Belem (PA) by NGOs, labour unions, organizations supporting land reform, and the Belem City Council. Around 500 people attended—(but the representatives of Monsanto did not turn up). In March 2004, around 30 NGOs organized the International Citizens' Jury on GMOs in Porto Alegre (Rio Grande do Sul State).

Their organizers presented these experiences as equivalent to those happening in several European Countries. They helped to make public the debate over controversial themes that were being debated only in closed circles. Nevertheless, the examples described here are really far from the European ones. They are events where a jury is dramatized, where actions are developed under pre-defined scripts. As an outcome, a potential space to construct a public debate about risks is being wasted.

To this kind of strategy, which seeks to *mobilize people*, rather than to *inquire about the public participation* in the debate, it is possible to add Greenpeace strategy regarding the voting of the Law Project in the Deputies Chamber. Its actions focused on the Campaign '*Essa não dá para engolir*' (we will not accept it), launched in October 2004, in Porto Alegre (RS). The campaign planned to visit 10 cities in nine weeks, in order to mobilize consumers to exercise their rights of access to information, demanding the enforcement of the Labelling Law and helping to create an opposition to the use of GMOs in Brazil.

More complex studies on public perception of science and of scientific perception of the public and of their own field are of fundamental necessity, not only to outline future scenarios relative to the development of certain technological innovations. Instead of seeing technology as an independent variable, research efforts should seek to establish technology and society as interdependent variables, creating the conditions for a greater participation of citizens in the decision-making process regarding technologies involving uncontrollable risks, with greater transparency about who loses and who benefits from them. But in the context of the prevailing civic epistemology, this sounds very distant to be accomplished.

A Declaration from the Brazilian Rural Society's (SRB) President summarizes some of the favourable positions and proposals (<http://www.srb.org.br/index.php3?news=1671>):

1. There is assurance of food safety, since no study was successful in proving that GMOs may pose threats to human health. According to the SRB's president, what actually exists are reports attesting the safety and the same nutritional value of transgenic products when compared to the traditional ones.
2. About the impact of GMOs on the environment, he states that studies must be undertaken by CTNBio, in all the country's regions, to evaluate the impact GMOs may cause.
3. The marketplace is to decide if it will prefer the traditional or the transgenic production: that means, if it will pay extra for one of them. That is exactly why Brazil should have both sorts of plants.

To these points we can add rejection of the precautionary principle, the latter identified as a tool to immobilize the country through prejudice (seen as pure ideology). The need for labelling was also questioned, because of the costs implied. According to several declarations made by the Ministry of Science and Technology, it is a costly process, demanding the whole industry production chain to be analysed. In order to label such products, it would be necessary to segregate all GMOs from non-GMOs, from the planting stage to the storage, transportation and processing. Cenargem's researchers are presenting equivalent findings. They consider labelling costs to be very high and unfavourable, especially for smaller and non-commodity crops. The costs of traceability, fundamental for a reliable labelling, were also called into question.

Most of the actors in this coalition agree that GMOs must be managed 'in a scientific manner, without ideologies and parties being involved', making a clear appeal to the standard model of science. The other coalition was identified with positions that are exclusively ideological, aiming at creating legal impediments for any advancement obtained by the scientific research, since it would hinder the transferring of technology to agribusiness. If the genetic research cannot be transferred to the productive sector, the country will not advance.

The same argument was assumed by the SBPC, which had already announced this position since the Deputies Chamber's debate, and FAPESP's Supreme Council. In a document delivered to the Senate's president, José Sarney, by the scientific director, José Fernando Perez, the foundation demanded that congressmen listen to the representatives recognized by the scientific community, using the Law Text as an instrument for progress and technological independency, avoiding thus the irrecoverable damages to be otherwise caused to the development of knowledge and generation of wealth' (Revista Pesquisa Fapesp, 97, 2004).

It is surprising that there are no arguments questioning this way of viewing science among those researchers that are part of this coalition, who seem to ignore the international debate and the criticism against this model of science in mainstream sectors. In order to better understand this, I can mention the fact that experts do not inquire about such issues (different from the growing suspicion identified in several European researches and theoretical analyses) Another issue that is ignored is the radicalization of the debate by the other coalition, which also has a heterogeneous character (MST leaders' declarations help illustrate this point) and presents proposals that are weakly embedded in the Brazilian context—only reinforcing the view that its

position is merely ideological, influenced by foreign interests (like Greenpeace International), and, to say the least, controlled by the pesticide industry.

For understanding the positions, the definition of civic epistemology is quite appropriate. According to Jasanoff (2005: 255):

... modern technoscientific cultures have developed tacit knowledge-ways through which they assess the rationality and robustness of claims that seek to order their lives; demonstrations or arguments that fail to meet these tests may be dismissed as illegitimate or irrational. These collective knowledge-ways constitute a culture's civic epistemology; they are distinctive, systematic, often institutionalized, and articulated through practice rather than in formal rules.

An interesting case of this opposition between science and ideology was Lula's speech in August 2003. He affirmed that before he had an ideological position (meaning that he was in favour of the moratoria and the use of the precautionary principle without any scientific ground, and reasoning in mere political terms), but from that moment on he was convinced of the truth of the scientific argument, that showed no significant risks in relation to GMOs.

## FINAL COMMENTS

There exists an ongoing process among governments, industrial sectors, researchers and so on acknowledging that expert opinion should be more transparent and reliable (European Commission 2001). The citizens' participation (their commitment on decisions about public policies) is a central piece of the new forms of governance being experienced mainly in some European countries. This involvement can be interpreted as 'the democratization of expertise', which does not necessarily mean the loss of expertise. According to this approach, 'democratizing expertise' goes hand-in-hand with 'expertising democracy', that is, providing institutions and citizens with more and more technical and scientific knowledge – usable and of good quality (Pellizzoni 2003).

The global pressures that may influence the debate over GMOs must be considered, since they may lead to transformations in the way coalitions are formed and also the power relations between them. Apart from the fact that discussions about GMOs are taking place in various international forums (Cartagen Protocol, Biodiversity Convention, World Intellectual Property, the WTO, the Codex Alimentarius, the International Plant Protection Convention and OECD), there exists the dynamics of global networks against or favourable to them, that will have an influence over regulations beyond national bound-

aries, in a process of balance between national and global forces. As pointed out by Oosterveer (2003), it is possible to identify inside the conflict, regulatory models based on different discursive networks, regrouping fluid coalitions formed by nation-states and non-state actors, seeking to influence other nation-states (such as China and the southern Africa to better control global regulation. With these conflicts between the European Union and the United States, NGO networks and farmers associations proposing radical actions against the production and commercialization of GMOs will become quite limited as soon as national biosafety laws have been enacted. Whether such disputes end up in one global regulation or in several national ones will depend on the power balances of diverse political and economic interests, and on how the disputes taking place inside the WTO progress.

The future regulations will also depend on the ability of NGOs to redirect their actions, on new scientific information and/or circumstances that may lead to generalized alimentary panic in some regions and, for this reason, on consumers' responses. Any new regulation must include consumer concerns and must be willing to acknowledge environmental problems. This depends not only on the features of the regulation, but also on the very process by which it will be defined.

The Brazilian debate on GMOs exposes a scenario polarized between heterogeneous coalitions with several international alliances, in favour of or against GMOs' liberation. Although those who criticize their liberation endorse the 'precautionary principle' and those favourable to it endorse the principle of 'substantial equivalence' between GMOs and the conventionally grown crops, it is surprising that both sides have, at times, resorted to the same standard model of science (assuming both axes we identified: no problematization of science nor of the public) and risk and innovation management. Both coalitions explain the contrary positioning as ideological and demagogic and their own as scientific. References are made to a kind of science based fundamentally on the positivist model, by which knowledge is neutral and not subject to human values. The arguments used by the alliances against the liberation of GMOs do not exactly question the role played by science in the matter, neither do they believe that science is subject to values; but instead, their positioning relates to a science that is less contaminated by economic and political interests.

The forms of participation proposed by the coalition against the liberalization of GMOs can be situated in the lowest levels of the schemes presented previously. This strategy, together with other more aggressive (burning fields, etc.), contributed to the final re-consolidation of the standard model. The attitudes and actions of the coalition against GMOs (the one that could have

the opportunity to bring new issues in the debate) also contribute to the polarization, and delegitimation of the possibility of implementing other more creative and democratic ways of public participation and governance (as we have seen in Tables 19.1 and 19.2).

Because the same model of science is accepted by both parties, the debate about the importance of creating effective forms of consultation and participation, happening now in EU countries, has been left behind in Brazil. In Brazil, for those sectors in favour of GMOs, consumers ought to be better informed, according to the previously mentioned deficit model. This would lead to the unrestricted acceptance of GMOs. The debate is seen as something happening between progressive forces and obscurantist forces. For the sectors against the liberation, the demand for public participation is restricted to citizen panel's experiences, a simple parody of what the democratization of science could be.

The limits of the debate pointed out here can be an opportunity for social learning, acknowledging the need for thinking how and when the strategies of public participation in decision-making processes about uncontrollable risks should be created. However, it is important not to be naive in relation to the possibilities of transforming civic epistemologies. And this is also is not the issue of assuming that public participation implies immediate transparency and a dialogical democracy (Callon et al. 2001) without denying the need for the authority's long-term commitment to conduct those processes in an unbiased manner (so that the different positions can be expressed and spread with equal opportunity).

## NOTES

1. 'GM Nation? A Public Debate', [http://www.gmnation.org.uk/docs/\(gmnation\\_finalreport.pdf\)](http://www.gmnation.org.uk/docs/(gmnation_finalreport.pdf))
2. Health Canada anticipated learning from other countries experiences and perceptions so that it could increase the transparency of its own review and regulatory process. The opinions of a cross-section of stakeholders in the USA, the EU (especially the UK), Australia and New Zealand, solicited via an e-mail survey, were analysed.
3. The supermarket sector, differently from its role in the coalition against GMOs (in contradiction to its role in the coalition against GMOs), did not engage in the debate actively.
4. Franco M. Lajolo, of the Food and Experimental Nutrition Department, USP (University of São Paulo), in *Ciência Hoje*, April 2004, vol.34, n.203: 36.
5. Depending on the quantity of residues, glyphosate can cause serious health damages.
6. See Greenpeace's position in [http://www.greenpeace.org.br/transgenicos/?conteudo\\_id=2396&sub\\_campanha=0](http://www.greenpeace.org.br/transgenicos/?conteudo_id=2396&sub_campanha=0)
7. The defence of the precautionary principle, ratified by Brazil in Eco 92, is one of the major principles of this coalition until today.

## REFERENCES

- Beck, U., *World Risk Society* (London: Polity Press, 1999).
- Callon, M., 'Des différentes formes de démocratie technique', *Annales des Mines-Responsabilité & Environment*, 9, 1998: 63–72.
- Callon, M, P. Lascoumes and Y. Barthe, *Agir dans un monde incertain. Essai sur la démocratie technique* (Paris: Seuil, 2001).
- Felício, P. de, 'Rosnados e Mugidos', *Agroanalysis*, 21(2), February 2001: 42–48. (Fundação Getúlio Vargas: São Paulo).
- Folha de São Paulo, 'Brasil não tem condições de certificar todos as transgênicos', 2003, <http://www.1.folha.uol.com.br/folha/dinheiro/ult91u65106.shtml> (last accessed on 4th December 2007).
- Giddens, A., *Modernity and Self-Identity. Self and Society in the Late Modern Age* (Stanford: Stanford University Press, 1991).
- [http://www.gmnation.org.uk/docs/\(gmnation\\_finalreport.pdf\)](http://www.gmnation.org.uk/docs/(gmnation_finalreport.pdf))
- Godard, O., C. Henry, P. Lagadec and E. Michel-Kerjan, *Traité des nouveaux risques* (Paris: Gallimard, 2002).
- Green Alliance, *Steps into Uncertainty: Handling Risks and Uncertainty in Environmental Policy-making* (London: Green Alliance, 2000).
- Grove-White, R. 'Afterword: on Sound Science, the Environment, and Political Authority', *Environmental Values*, 8, 1999.
- Grove-White, R., P. Macnaghten and B. Wynne, *Uncertain World: Genetically Modified Organism, Food and Public Attitudes in Britain*, A research report by the Centre for the Study of Environmental Change (Lancaster University, 1997).
- , *Wisening Up. The Public and New Technologies*, A research report by the Centre for the Study of Environmental Change (Lancaster University, 2000).
- Guivant, J., 'A trajetória das análises de risco: da periferia ao centro da teoria social', *Revista Brasileira de Informação Bibliográfica em Ciências Sociais, ANPOCS*, 46, 1998.
- , 'A teoria da sociedade de risco de Ulrich Béch: entre o diagnóstico e a profecia. *Estudos Sociedade e Agricultura*. Rio de Janeiro, v. 16, 2001a.
- , 'Global Food Risks: Environmental and Health Risks in Brazil, in Daniel Hogan and Maurício Tolmasquim (eds), *Human Dimensions of Global Environmental Change. Brazilian Perspectives* (Brazilian Academy of Sciences: Rio de Janeiro, 2001b).
- , 'Heterogeneous and Unconventional Coalitions Around Global Food Risks: Integrating Brazil into the Debates', *Journal of Environmental Policy and Planning*, 3(2), 2002a.
- , 'Riscos Alimentares: Novos Desafios Para a Sociologia Ambiental e a Teoria Social. *Revista Desenvolvimento e Meio Ambiente*. n. 5/2º semestre (Dossier da Revista NSS-Natures, Sciences, Sociétés. Paris, DUNOD). Curitiba, Editora da UFPR, 2002b.
- , 'Os supermercados na oferta de alimentos orgânicos: apelando ao estilo de vida *ego-trip. Ambiente e Sociedade*, 6(2), 2003.
- Irwin, A., *Sociology and the Environment* (Londres: Polity Press, 2001).
- Irwin, A. and B. Wynne, 'Introduction', in A. Irwin and B. Wynne (eds), *Misunderstanding Science?* (Cambridge: Cambridge University Press, 1996), pp. 1–17.
- Jasanoff, S., *Designs on Nature. Science and Democracy in Europe and the United States* (Princeton, NJ: Princeton University Press, 2005).
- Joly, P.B. 'Les OGM entre la science et le public? Quatre modèles pour la gouvernance de l'innovation et des risques', *Economie Rurale*, 266, Novembre-Décembre, 2001: 11–29.
- Klinton, M., 'The Genetically Modified Food Labelling Controversy: Ideological and Epistemic Crossovers', *Social Studies of Science*, 32(1), 2002: 71–91.

- Latour, B., 'To Modernize or to Ecologies? That Is the Question', in B. Braun and N. Castree (eds), *Remaking Reality. Nature at the Millennium* (Londres: Routledge, 1998).
- , *Politiques de la Nature. Comment faire entrer les sciences en démocratie* (Paris: Ed. La Découverte, 1999).
- Levidow, L. 'Precautionary Uncertainty: Regulating GM Crops in Europe', *Social Studies of Science*, 31(6), December 2001: 845–78.
- McGregor, S., 'Government Transparency: The Citizen Perspective and Experience with Food and Health Products Policy', *International Journal of Consumer Studies*, 27(2), March 2003: 168–75.
- Murphy, J., L. Levidow, and S. Carr, 'Regulatory Standards for Environmental Risks: Understanding the US-European Union Conflict over Genetically Modified Crops', *Social Studies of Science*, 36(1), 2006: 133–60.
- Nestle, M., *Safe Food: Bacteria, Biotechnology, and Bioterrorism* (Berkeley: University of California Press, 2003).
- Oosterveer, P., *Genetically Modified Food and Its Regulation in the Global Network Society* (Versão não publicada, 2003).
- Pellizzoni, L., 'Knowledge, Uncertainty and the Transformation of the Public Sphere', *European Journal of Social Theory* 6(3), 2003: 327–55.
- Rowe, G. and L. Frewer, 'Public Participation Methods: A Framework for Evaluation', *Science, Technology & Human Values*, 25(1), Winter 2000: 3–29.
- , 'Evaluating Public Participation Exercises: A Research Agenda', *Science, Technology, & Human Values*, 29(4), Autumn 2004: 512–55.
- Senado Federal, *Seminário Internacional sobre Biodiversidade e transgênicos*. Anais (Brasília: Senado Federal, 1999).
- Sorj, B., *A nova sociedade brasileira* (Rio de Janeiro, 2000).
- Stirling, A. and R. Grove-White, Submission to the House of Commons Science and Technology Select Committee Inquiry on *The Scientific Advisory System for Genetically Modified Foods* (1999).
- Wynne, B., 'Misunderstood Misunderstanding: Social Identities and Public Uptake of Science', in A. Irwin and B. Wynne (eds), *Misunderstanding Science? The Public Reconstruction of Science and Technology* (Cambridge, 1996).

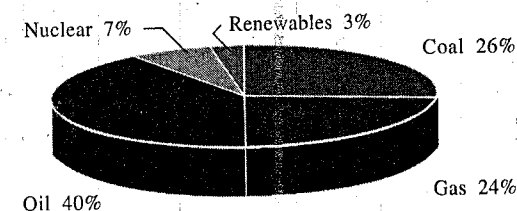
## CHAPTER 20

## FLY ASH: ENVIRONMENTAL AND UTILIZATION PERSPECTIVES

Debasis Goswami and Arabinda K. Das

In thermal power plants the major part of the incombustible fine particles leave with combustion gases as fly ashes causing air pollution in surrounding areas. No doubt the installation of thermal power plant brings a significant socio-economic development in the area. It increases the availability of power, money circulation improves the literacy level and educational standard. It results in the migration of industrial workers in the area and avenues for different types of employment.

Figure 20.1: Total World Primary Energy Consumption (% by Fuel)



Global energy consumption per capita is showing an increasing trend and its requirement is compensated mostly by electricity. Figure 20.1 gives an idea about the percentage of various fuels used in the world from which it is clear that oil contributes the most and coal contributes about one-fourth of total energy consumption. Electricity may be generated from nuclear power, coal-based thermal power or from hydel power stations. Though the generation cost of electricity is less in nuclear power stations and from hydel power stations, the cost of construction of these stations is three to four times higher