International Journal of Technology and Development Studies
Volume 2, Issue 1 (2011), pp. 2-29
URL:www.ijtds.com
ISSN: 2211-0313

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Sustainability and the EU Controversy on Agri-Biotechnology:

Radical Change or Ecological Modernization?[2]

Keywords: ecological modernisation, biotechnology, social controversy, sustainability, technological trajectories

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[2] This paper was presented, and substantially benefitted from comments received, at the "First International Conference on Social Economy and Sustainability" 21-25 September 2010, Maringá State University/Brazil. I am particularly indepted to Wânia Rezende Silva from Maringá State University. Funding was provided by the Austrian Science Fund (P 21812-G17)

ABSTRACT: *This article reviews the conflict over agri-biotechnology in the European Union and discusses its implications for global sustainable development. The public controversy over agri-biotechnology is driven by one of the most powerful movements in the environmental arena in recent times. The regulatory reform it has triggered in the EU constitutes an important policy impulse for supporting a more precautionary and consumer-oriented product policy. Moreover, it sends a message to movements, farmers, industries and decision-makers around the world. How did this development come to pass? What course did it take over 15 years? What were its outcomes in terms of markets, regulation and discourse in and beyond Europe? The analysis of the controversy's implications for sustainable development will draw on two conceptual lenses: ecological modernization and radical change. As far as substantial consequences in the economic and regulatory domains are concerned, these turn out to be variations of ecological modernization. In the discursive and movement arena, concepts of radical change have their place as well. In some key respects, such as techno-industrial pathways, global feed markets and fundamental regulatory principles, the controversy's impact on existing trends and regimes were nil.*

INTRODUCTION

This article discusses the implications of the controversy over agri-biotechnology for global sustainable development. The question suggests itself: agri-biotechnology, or the deployment of genetically modified (GM) crop plants, marks a historic step in the rise of agricultural productivity characterising the modern age. GM crops entered global seed markets in the mid-1990s and, since then, have played a momentous role in agricultural production around the world. Starting with a modest 1.7 million hectares in 1996, GM crops occupied 134 million hectares in 2009, which translates to an almost 80-fold increase in 14 years. Also, the number of countries growing GM crops has increased steadily, beginning with six in 1996 and growing to 18 in 2003 and 25 in 2009.

However, the technology's apparent success and global rise have been accompanied by unceasing criticism and controversy over the years. Critics denounce the very idea of releasing genetically modified organisms (GMOs) into the environment. According to them, the environmental release of a transgenic organism is likely to set off an irreversible destructive dynamic and entails unforeseeable harm to nature and human health. Another type of critique emphasizes the supposed social consequences of the technology: in its present form, agri-biotechnology is the result of bio-industry's quest to tap new sources of profit. To secure a return on long, expensive and risky R & D, GM products are covered by a comprehensive system of exclusive intellectual property rights (IPR), which has the effect of aggravating farmers' dependence on seed and agrochemical suppliers. Moreover, GM crops are said to fit into a model of capital-intensive, industrial agriculture designed to boost productivity in order to compete in global markets, instead of addressing nutritional needs of resource-poor, small scale farmers in the developing world. Although we will refrain from a detailed account of the scientific arguments unfolding around these claims at this point, the next chapter offers a closer look at these lines of

inquiry.

Concomitant with the commercial launch of GM crops in the mid-1990s, an international controversy over their use erupted, seemingly with the potential to alter the trajectory of the GM technology in agriculture. The EU was a hotspot of contention. Among the most notable developments in the EU were the following: European consumer markets virtually banned GM food; between 1999 and 2004, the EU imposed a five year moratorium on GM crop authorizations; several EU countries issued bans on GM products already authorzed for release in the community market; and today, GM crops are grown on a negligible fraction of EU terrain. Given the EU's political influence and market power, the EU anti-GM turn also had global effects, for instance, on international negotiations and product policies of trade partners in the developing world. Therefore we have good reasons to assume that not only agri-biotechnology's global rise but also the controversy surrounding it is having a considerable impact on global technology and environmental choices and, thus, on global sustainability.

Which leads us to the question: what is sustainability? The most often-cited definition applies to the term "sustainable development," which the milestone Brundtland Report (1987) defined as development that "meets the needs of the present without compromising the ability of future generations to meet their own needs" (1987).[3] Most authors agree that the popularity of the term, which came to predominate the environmental discourse in the past two decades, is mainly due to the fact that this is a rather broad definition that allows much room for further interpretation and enables different interests to interpret the term to suit their agendas.

Yet the definitional problem posed by sustainability must be addressed. The fact that sustainability has become a ubiquitous political term does not mean that it identifies a specific situation or state. Rather, sustainability states a goal for the future. How to reach this goal remains an open question. Sustainability must be understood as an "essentially contested concept" equivalent to terms like "democratic participation," "social justice" or "liberty"— terms that are simultaneously ambiguous and constitute core values of western civilization. Like these terms, "sustainability" functions as a "site of discursive struggle" (Hajer 1997) where a multitude of stakeholders seek to influence and shape the discourse surrounding a seemingly agreed upon value or concept. To be fair, a reflection like the one attempted here can therefore be only a tentative one and needs to recognize the uncertainty, disputed ambiguity, and potential multitude of developmental pathways to sustainability. To evaluate the process at hand, I

[3] Later, the UN commitment to sustainability was reaffirmed in international charters like the Millennium Declaration (2000), the Millennium Development Goals (2000), and the United Nations' Millennium Ecosystem Assessment (2001-2005). In the EU, sustainability was raised to constitutional status in 1997 when it was included in the Treaty of Amsterdam as an overarching objective of EU policies. At the Gothenburg Summit in June 2001, EU leaders launched the first EU sustainable development strategy based on a proposal from the European Commission.

will thus propose two versions of sustainability, or two alternative lenses through which the empirical process can be scrutinized. I call these the "ecological modernization" model and the "radical change" model, respectively. While the "realistic" ecological modernization model does not question the foundations of today's global socio-economic system, but rather regards them as the key to sustainable development, the radical change model calls for a radical departure from current norms and practices in lifestyle choices, the economy and political power structures. Both models reflect common, albeit contrasting, ways of thinking about sustainability. I do not propose these models with the intention to side with one or the other, but rather as devices that help to order the problem under consideration.

Before coming to the evaluation, this article proceeds as follows. The next chapter will carve out some key aspects of the industrial logic underlying the spread of "first generation" GM crops. The third part will review the EU's backlash against agri-biotechnology, paying particular attention to the contribution of critical social movements, explain the logic of EU reform in the regulation of GM products, and sketch the global ramifications of the EU backlash. The conclusion depicts a complex pattern of the GM controversy's preliminary outcomes and evaluates them according to the alternative accounts of sustainability just introduced, the "ecological modernization" model and the "radical change" model. The materials used for this article draw on various analyses in the literature and on data from an ongoing study on the European anti-biotechnology movement.

AGRI-BIOTECHNOLOGY'S DEVELOPMENTAL LOGIC

Is agri-biotechnology an unsustainable technology? Countless studies have tackled this question, or particular aspects of it, and have typically arrived at contrasting conclusions that correspond to the respective guiding research interest. We distinguish two categories of arguments for these studies: one concerns physical risks, i.e., risks to human health and the environment, and the other considers socio-economic factors. A consensus has never been reached for either of these categories. In fact, the scientific debate, presented to the public as factual and impartial, rather extends and prolongs the political controversy instead of ending it by allowing "objective knowledge" to arbitrate.

The irresolvable nature of the scientific debate, even where it concerns "factual" questions such as health and environmental risks, is illustrated by regulatory disputes over the authorization of GM crops in the EU. Today, six EU member states—Austria, Hungary, France, Greece, Germany and Luxembourg—have adopted "safeguard measures" prohibiting the cultivation of MON810, the only GM crop authorized for EU-wide cultivation, on their territories. These GM seeds were admitted for marketing in the EU because they had been declared safe for human consumption and cultivation beforehand, through procedures and institutions guaranteeing that product approvals are conducted in a scientifically

sound way. However, member states who refused to recognize these decisions and issued national bans likewise justified the bans with scientific arguments brought forward by their national competent authorities, and they continued to defend these bans after subsequent scientific re-assessments by European authorities declared them null and void. In this way, the scientific debate on the safety of GM crops was inconclusively prolonged for years and defied resolution by even the highest-ranking European scientific authorities.

If scientific consensus (commonly accepted as proxy for objective knowledge) on these "factual" dimensions of biotechnology hazards is still beyond reach, the chance of coming to a common conclusion on such complex matters as the sustainability of agri-biotechnology seems to be even more remote. Indeed, a contest of expert opinions is stirred by questions about whether agri-biotechnology makes a contribution to fighting world hunger (Royal Society 1998), or whether it benefits not only large-scale and industrial agriculture but also resource-poor farmers around the world (Glover 2009, Pray and Naseem 2007). While I cannot examine these questions exhaustively, I will nevertheless take them up again and elaborate on several aspects of agri-biotechnology industrial logic.

A look at the global diffusion of the technology offers the first hint about this developmental logic. Agri-biotechnology's steady rise over the past 15 years has been mentioned. Note, however, that this spread is limited to a small number of dominant crops—soybean, maize, cotton and canola—all of which play a key role in industrial, export-oriented agriculture.[4] Consequently, GM crop use is geographically concentrated in major agro-exporting countries, with the U.S.A., Brazil and Argentina holding roughly 80% of the GM crop area.

Furthermore, current use is restricted exclusively to a "first generation" of GM crops. This crop type differs from conventional varieties only in that the added "input traits" such as insect herbicide-, pest- and disease-resistance enhance the efficiency of production, thus meeting producers' demands. "Second generation" GM crops, by contrast, carry output traits that change the composition of the final product, such as improved nutritional content that bring advantages to consumers (a well-known example is "golden rice," genetically modified to contain ß carotene), or drought resistance and anti-salinity that address agricultural problems.[5] The fact that the second generation has not even reached the commercial stage, while global GM markets have been dominated by first

[4] The principal biotech crop in 2008 was GM soybean, occupying 53% of global biotech area and 77% of global soybean production. This was followed by GM maize (30% of the global biotech crop area and 26% of global maize production), GM cotton (12% and 49%, respectively) and GM canola (5% and 21%, respectively). GM soybean carries traits providing herbicide tolerance, GM maize is mostly furnished with stacked GM traits combining multi-herbicide and pesticide tolerance, and GM cotton is also increasingly endowed with stacked traits uniting herbicide and pesticide tolerance (James 2010).

[5] Transgenic plants used for pharmaceutical production, such as ingestible vaccines, antibodies and proteins, are termed "third-generation" products.

generation crops for over 15 years, is revealing. Firstly, it testifies to the slowness of the GM crop innovation cycle. The entire process can take 10 to 15 years, from the initial research and designing a product strategy to commercial realization. Statutory safety testing, in particular, is a lengthy and uncertain process, making GM product development an overly expensive and risky business that requires substantial financial resources. Biotech companies, therefore, focus on a small number of products which, firstly, are profitable; secondly, have been the subject of scientific research for a considerable length of time; and thirdly, could be implemented fairly rapidly.

For the same reason, biotech industry underwent massive concentration in the course of the past three decades so that today, five major seed and agrochemical companies—led by US Monsanto—share the market for first generation GM crops. Wield et al. (2010) show that, while these five multinational biotech companies pursue specific product strategies, the composition of the powerful group has not changed during the past 15 years. This, in turn, suggests that, after 15 years of commercialization and global contention, industries adhere to the same technological trajectories (See Figure 1).

Figure 1. Still "first generation": Number of commercially approved (world) GM crops by company

Crop	Monsanto	Pioneer (DuPont)	Bayer-Aventis-AgrEvo	Syngenta Seeds	BASF
Maize	18	5	4	12	1
Cotton	7	-	2	1	-
Soybean	2	2	4	-	-

Source: Wield et al. 2010

It is a matter of dispute whether agro-biotechnology's benefits reach beyond industrial, large-scale farmers who are capable of effectuating the requisite investments to meet the needs of resource-poor peasants as well. A number of sources—sometimes close to industry—provide evidence that small farmers around the world benefit from first generation GM crops (e.g., ISAA 2009, Brookes and Barefoot 2009). They do not remain uncontested, however. Glover (2009), for example, argues that small peasants have not benefited from GM crops to the same extent as large farmers have. He also denounces the fact that supportive studies regularly rely on industry data, are often methodologically flawed and, most significantly, treat producers in developing countries in an undifferentiated manner and ignore the socio-economic distinctions among them. In view of this ongoing debate on biotechnology's alleged benefits to the global poor, we identify a need for further research on socio-economic factors influencing GM crop adoption and its social consequences, particularly tackling the question of what different classes of producers in developing countries gain from the use of these plant biotechnologies. In a similar vein, after a review of

controversial studies, Wield et al. conclude that:

GM crops are increasingly important and can provide decreasing chemicals costs and increasing farm incomes. The benefits so far, however, are associated with a small group of (albeit important) crops, for a relatively small number of farmers, in a few, mostly large, producing countries. Unfortunately, there is a major gap in research data on the differentiated nature of GM production. There are a range of micro-studies concerning the nature of production, which suggest that smaller-scale capitalist producers are important in India and parts of South Africa, but there is no information to support reliable generalization. Second- and third-generation crops are increasing as a proportion of field trials, but have not been adopted in any significant extent as yet. And, as yet, R&D has not focused on major agricultural problems such as drought. (Wield et al. 2010, 354-5)

R & D BEYOND THE INDUSTRY TRAJECTORY

In spite of agri-biotechnology's developmental logic channelling product innovation into a small number of cash crops owned by a handful of multinational corporations, there appears to be scope for alternative technological and socio-economic trajectories. Wield et al., for example, emphasize that second generation GM crops may be designed in alternative ways, which, for example, convey characteristics such as stress tolerance and nutritional enhancement, in order to bring benefits to a broader range of farmers and consumers. They envision a key role of public R&D and investment in generating these alternatives and outline different strategies for appropriating biotech innovation that circumvent and undermine corporate-dominated regimes of intellectual property rights.

The authors point to newly industrializing countries like China, India, Argentina and Brazil, who have become key players in transgenic technologies R & D. China, in particular, is leading in GM rice technology and, in contrast with biotechnology innovation in developed countries where most products come from the life science industry, in China biotechnology R & D is clearly a public sector project. Furthermore, international agricultural research centres, and especially the Consultative Group on International Agricultural Research (CGIAR), bring substantial funding to biotechnology R & D for developing countries. In 2008, nine of the 15 worldwide distributed CGIAR centres were conducting research on 15 different GM crops, most of which are still at the laboratory stage. Only the Golden Rice Project, under the International Rice Research Institute (IRRI) in the Philippines, has started field trial testing, and approvals for release are expected in 2011 (Wield et al. 2010, 357).

In tackling a major criticism against agri-biotechnology—the denouncement of intellectual property rights regimes in GM seeds that aggravate farmers' dependency of corporate right holders—the authors identify tendencies undermining these regimes. They quote episodes in developing countries in

which farmers illegally appropriated GM seeds, disregarding both national legislation and corporate property protection, while state authorities proved incapable of reinforcing legislation. Unruly farmer movements, in turn, managed to impact upon approval decisions and even to adapt the technologies to their needs and create their own locally sold GM hybrids (see also Herring 2007).

In summarizing this section, we recall our initial question: is agri-biotechnology an unsustainable technology? The response above attempts to extend beyond common controversial positions and do justice to agri-biotechnology's complex reality and potentialities. Firstly, I pointed out the persistent uncertainties surrounding the "scientific" issues of harm to the environment and human health and how these opposing arguments are mainly driven by political divergences. Secondly, instead of drawing a scenario of agri-biotechnology's future impacts in the social and ecologic realm, I reconstructed the technology's developmental logic against the background of 15 years of commercial diffusion. The emerging picture confirms the criticism of corporate concentration and testifies to the industry's fixation on a small number of profitable crops designed to fit capital-intensive agriculture. This supports the conclusion that agri-biotechnology, at least in its current form, is not tailored to meet criteria of social and ecological sustainability but rather follows a profit- and efficiency-driven, industrial logic. However, this criticism does not capture the entire picture. Technically, agri-biotechnology offers the possibility for enhancing crops according to the social needs of developing countries' producers. Requisite public research infrastructure and R & D programmes are provided by an increasing number of newly industrialising states and international research institutions, and local social movements often prove capable of bending legal frameworks of intellectual property protection according to their needs.

EU BIOTECH POLICY EVOLUTION

The following section turns to the EU controversy over agri-biotechnology and its international ramifications. The first part outlines a brief chronological sketch of the domestic EU controversy that should enable us to understand its underlying logic. EU policy evolution is driven by the struggle between two countervailing forces, the domestic contention between member states and the European Commission on the one hand, and pressures to conform to international free trade rules on the other (e.g., see Pollack and Shaffer 2005).The seed of the EU controversy was laid in the late 1980s, when the European Community (EU since the Maastricht Treaty) assumed authority over the regulation of biotechnology. It adopted a horizontal approach to regulation, harmonizing national biotechnology regulations with the objective of aiming for a high level of health and environmental protection whilst ensuring the free movement of goods in the internal market. In the first step, in 1990, a biotechnology directive regulating the deliberate release of GMOs into the environment, which also includes the commercialisation of GM crops, was

adopted. EU-wide regulations on food labelling, however, remained a controversial issue for much longer. The first Commission proposal dates from July 1992, but it was not until May 1997 that the "Novel Foods" regulation entered into force. This decision was too late to mitigate the incipient controversy over biotechnology that came to dominate the following years and set the course for a radical turn in EU biotechnology regulation and policy.

In the year 1996, two events coincided to trigger the public controversy (see also Ansell et al. 2006, 97). Firstly, the UK government announced that a transmission of the cattle disease bovine spongiform encephalopathy (BSE) to humans through the consumption of infected beef could not be ruled out, and the European Commission's mishandling of the situation caused widespread mistrust in food authorities. Secondly, shiploads of U.S.-grown GM corn and soybeans began to arrive in European ports and, as the Novel Foods regulation was still in dispute and left important gaps in food labelling, these were mixed into food products in an uncontrolled manner. Seizing the opportunity of a European public alerted to food risks, a social movement opposed to GMOs emerged, initially at a slow pace, but later advancing at an ever-increasing rate. Both industries and states reacted swiftly. Targeting food manufacturers and retailers, activists took advantage of consumer concerns—the industry's Achilles' heel. By lobbying retail managers, keeping "black lists" and orchestrating supermarket campaigns, NGOs like Greenpeace and Friends of the Earth played one retailer against another in an effort to force the major supermarket chains to reject GM food. Put on the defensive, the major European supermarket chains ultimately stopped selling GM food towards the end of the 1990s (Schurman and Munro 2010, 102).

However, the movement also quickly seized state governments. The first country to adopt a strictly oppositional stance to agricultural and food biotechnology was Austria. A field trial in spring 1996 escalated into a scandal. In April 1997, a popular initiative against biotechnology resulted in a clear vote against the technology. From 1997 on, a number of European countries went through similar controversies, which arrived at their heyday in 1998 and 1999. In small countries like Denmark, Ireland, Greece and Italy, as well as in big nations such as France and Great Britain, public controversies surged and brought about changes in national policies. From 1997 to 2001, the governments of Austria, France, Germany, Greece, Italy, Luxembourg, and the United Kingdom (the only country to later reverse its decision) issued bans on GM varieties that had been permitted for marketing in the EU before, thus undermining the EU approval process. By 1998, a de facto moratorium against the planting of GMOs came into effect, as no further approvals passed the scientific review process. At the Council of Ministers in the summer of 1999, the governments of France, Greece, Denmark, Italy and Luxembourg declared they would block any future approval. In the course of the moratorium, which lasted until 2004, critical member states pressured the Commission to adopt ever-tighter regulations in the form of cumbersome risk assessment and approval procedures, the internationally

contested precautionary principle, and comprehensive traceability and labelling provisions which made the introduction of GM materials into the European food chain a burdensome and—for applicants—risky business. A major result of the combined effects of consumer backlash and aversive retailer policies, permanent protest campaigns, and the creation of a highly restrictive regulatory environment is that GM food is virtually absent from European supermarket shelves. Yet, in some respects, the new regulatory framework would also centralize and thus facilitate the approval procedure. A case in point is the creation of the European Food Safety Authority (EFSA), which was assigned the key responsibility of conducting the risk assessment and thus replaced national expert agencies that had been instrumental in paralysing the EU approval process in the late 1990s. In May 2004, the European Commission finally lifted the moratorium by approving the import of GM corn and its commercial distribution in Europe on the basis of the new EU regulation on labelling and traceability of GMOs.

THE WTO LAWSUIT

In May 2003, about a year before the moratorium was lifted, the U.S., along with Canada and Argentina, filed a lawsuit in the WTO against the moratorium and the various national safeguard bans. Agricultural producers in biotechnology-friendly countries had invested heavily in assets specific to GMO technology. Now farmers and agro business in these countries claimed to face massive losses of income due to what the plaintiffs denounced as protectionist measures imposed by the EU. Throughout the dispute settlement process, there was a great deal of speculation about punitive tariff duties to be imposed on the EU and whether the eventual verdict would call into question the entire EU regulatory system's compatibility with international free trade rules. Anxious to fend off punitive measures and attacks on the EU's newly reformed regulatory structure, the Commission, which was conducting the legal defence, attempted to prove that the European regulations and policy practice were in line with WTO rules and denied the very existence of a moratorium, as there was no official document instituting a Community ban. Furthermore, GM product authorizations were being granted again by 2004. High stakes and public salience made for a protracted procedure. A WTO Dispute Panel normally takes a year to come to a verdict, but in this case it took until November 2006 for the final report to come out.

In its verdict, the WTO refrained from ruling on WTO-compliance for the EU biotech regulations in their entirety. However, the report proved the complainants' right, finding that, with the blockade on GMO authorizations and the persistence of national safeguard bans, the EU was violating the "undue delay" provisions of international free trade agreements. Altogether, the EU got off lightly with this ruling, chiefly because it did not affect the new regulatory framework. Furthermore, as the moratorium had been effectively ended in 2004,

claims for compensation were unlikely. It was clear, however, that the ruling would have an impact on member states with safeguard bans still in place. From the Commission's standpoint, member states had to be urged to lift safeguard bans and, thus, to restore full compliance with WTO rules.

THE POST-MORATORIUM YEARS

In the wake of the WTO verdict and under legal pressure from the U.S. and the WTO, the European Commission was eager to bring the EU's domestic situation back in line with WTO prescriptions. However, it met with enduring member state opposition. After the lifting of the moratorium the authorization process resumed, albeit reluctantly. Between May 2004 and March 2010, only 23 authorizations for GM plants were issued.[6] In no case, however, could these authorizations rely on member states' consensus, not even on a majority vote. Each authorization had to be issued by the Commission by a default mechanism. Furthermore, only one of these authorizations was granted for commercial cultivation, which remained a controversial issue in most countries.[7] All other approvals hold for the importation of the GMOs and their uses for food, feed and industrial processing.

States that were critical of agri-biotechnology remained unwilling to comply with EU decisions, and some imposed new bans: the only GM crop authorized for cultivation in the EU, the maize variety MON 810, was banned by Hungary in 2005, by France in early 2008 and by Germany in 2009. Meanwhile, the Commission repeatedly failed to muster the member state support required to force countries to have their bans removed.

By 2008 it had become clear that the EU-wide authorization framework and the practice of consistently putting forward decisions over the heads of a major faction of member states would continue to erode the EU's democratic legitimacy unless member states were given more discretion over GM crop cultivation. At the Environment Council in December 2008, therefore, national governments asked the Commission to revise the authorization procedure, and in summer 2010, the Commission came forward with proposals to combine the EU approval system with member states' rights to decide whether or not they wish to cultivate GM crops on their territory. The proposed amendment, which will be applicable to all GMOs that have been authorised for cultivation in the EU, allows Member States to restrict or prohibit the cultivation of GMOs on their territories. The authorization of the import and/or the marketing in the EU of authorised GM seeds, by contrast, cannot be revoked by member states.

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[6] Fifteen of these were to cover various strains of the economically significant GM maize, three of which were for GM rapeseed, two for soybean, and one each for GM sugar-beet, cotton and potato, respectively.

[7] The GM potato Amflora, developed by BASF Plant Science and authorized on March 2, 2010, is the first and (thus far) only GMO to be granted EU approval for cultivation.

In sum, from this section the contradictory logic of the EU's policy evolution should become apparent. Two countervailing forces drive this evolution. On the one hand, liberal trade regimes under the umbrella of the World Trade Organisation (WTO) also exert pressure on EU regulators to assure that regulations conform to international free trade rules. On the other hand, there is a tension between the European Commission's liberal approach to regulation and a group of EU member states that refuse to abide by EU regulatory decisions. This tension jeopardizes the project of an EU-wide product approval system, leads to a steady tightening of EU biotechnology regulations and, as its final manifestation suggests, brings about a devolution of decision-making power. Obviously, national governments' recalcitrant positions play a key part in the EU's response to agri-biotechnology. State policies, however, do not form in a vacuum, but instead are the outcome of a combination of opportunities, constraints and social pressures that are specific to a given national context. As to the matter at hand, a powerful social movement opposing agri-biotechnology has been instrumental in shaping these national contexts. This movement, therefore, will be the subject of the next section.

THE IMPACTS OF A NATIONALLY FRAGMENTED MOVEMENT

As the struggle between oppositional governments and EU regulatory authorities is key to understanding the specifically European way of aversely reacting to agri-biotechnology, national fragmentation is also a condition to take into account when looking at the civil society anti-biotechnology movement. This section highlights three distinct national controversies—the cases of France, Germany and Spain—to exemplify the correspondence between movement intensity and long-term state responsiveness.

France, Spain, and Germany represent poles on the European anti-GMO movement. The French movement constitutes an extreme case. Its core actors are the radical farmer association, the *Confédération Paysanne*, and activist networks denouncing neo-liberal globalisation. More than anywhere else in Europe, the French movement relied on personalisation, since most French identify the highly visible, radical farmer activist José Bové with the anti-GMO movement, as well as on methods of direct action—notably the public uprooting of GMO field trials conducted and claimed by the *faucheurs volontaires*— and the public staging of subsequent court trials against involved activists. This movement fuelled a particularly long and contentious public controversy. Its effects on domestic R & D policy in agri-biotechnology were among the most dramatic; in the mid-1990s, France was the country with most GMO field trials in Europe, while toward 2009 it had cut experimental outdoor research to virtually zero. At the European level, the French movement played a crucial part in compelling the national government to adopt a leading role among EU member states critical of agri-biotechnology, as was reflected in French support for the EU moratorium and its various safeguard bans.

Conversely, Spain represents the permissive end of the spectrum in Europe's agri-biotechnology landscape. Its anti-GMO movement, comprised of some farmers' associations and environmental groups, most visibly Greenpeace, is weak. Despite their continued efforts to raise public awareness, these groups have not been able to create a nationwide debate on agri-biotechnology and have failed to influence the regulatory process in any significant way. In fact, Spain is the only EU country *with* large-scale commercial cultivation of GM crops. A GM maize variety approved for commercial production in 1998 has since expanded to around 80.000 ha, for the most part in the autonomous communities of Catalonia and Aragon. Spain is also among the few EU countries in which field testing has not been significantly reduced.

The German anti-biotechnology movement, finally, occupies a position in the middle range. Even though it is among the longest standing in Europe, with effective Green Party involvement in biotechnology criticism reaching back to the mid-1980s, it reluctantly gained sway in the big European controversy of the late 1990s. Only in recent years have segments of the German movement radicalised, with some activists embracing the direct action tactics of the French movement by attacking field trials and seeking public acclaim through staged court cases. In 2000, the number of field trials in Germany was halved to less than ten annually in the following decade, a less dramatic drop than in France. At the EU level, Germany followed a middle course for many years. It did not, for example, join the group supporting the EU moratorium, and it was not until 2009 that the Federal Republic's government, under the pressure of the influential agricultural state of Bavaria, joined the group of countries banning MON 810.

What should become clear from the comparison is that the strength of a national movement— its visibility, insistence and popular support—and national policies correspond. The stronger the movement, the more inclined the respective national government is to adopt restrictive policies both in the domestic and the supranational arena. While it might be oversimplifying to regard civil movements as the sole drivers of state action in the EU's biotechnology policy evolution,[8] they doubtlessly make a substantial contribution to their national policies.

DOMESTIC OUTCOMES: MARKETS, REGULATIONS AND PRODUCT POLICIES

Fifteen years of European controversy left their marks on markets and regulatory provisions both within and beyond the EU. Regarding domestic responses, a chief and—to agro-exporters—most painful effect is that materials derived from GM crops are virtually banned from European food markets. This is

[8] Indeed, movement research largely established that the relationship between movement intensity and state responsiveness is not one of linear causation. A common observation, for example, is that movement radicalization typically is provoked by inaccessible and unresponsive states (Meyer 2004).

the combined result of autonomous market responses and the EU's strict labelling regime. As indicated above, retail chains in the late 1990s responded quickly to the European food crises and, anticipating hostile consumer reactions, forced food industries and producers to step out of GM soy and maize. The regulatory regime set up later by the EU, which effectively established the most rigorous GM labelling regime in the world, did the rest in rendering the EU food market almost completely inaccessible to GM producers.

As a consequence of barred food markets, GM crop farming in the EU, with the exception of Spain, practically came to a halt. In general, farmers refrained from cultivating GM seeds, as there is no demand from the food industry. Those European farmers who, beyond Spain, attempted to embark upon GM crop cultivation, as in several cases in France and Germany, became the targets of pushy local activist campaigns bullying them out of the undertaking.

Another effect of the European GM controversy is the rise of alternative product lines in the food sector guaranteeing that they were "GM-free." While GM-free labels have sprouted in a number of EU countries, these products are mostly organic food products for which general EU standards and regulations exist. Although EU labelling regulations require both unlabelled conventional and organic food not to exceed a 0,9 percent threshold of admissible adventitious "contamination" with GM materials, organic food products signal an even greater degree of "purity." Without doubt, organic product lines owe their rising popularity to a considerable extent to a bonus in consumer trust in the wake of European food crises.[9]

Moreover, industry R & D in plant biotechnology withdrew from Europe, and experimental field trials, both industry- and state-funded, dropped markedly in the 2000s. As outlined above, direct action campaigns in several countries, most massively in the UK and France, account for this decline, even though this is not the only factor. As a considerable number of field trials are conducted as pre-commercialization tests, the reduction of field experimentation is also a result of agri-biotechnology's commercial failure in Europe.

Yet the EU is not as hostile a place for GM exporters as these trends might suggest. In spite of consumer (actually retail and food industry) resistance, tight regulations, and unremitting anti-GMO activism, the EU is still a major importer of the GM grain used in animal feed. Since the labelling of the meat of animals fed with GM soy is not obligatory while, at the same time, intensive livestock farming in the EU heavily depends on imported soy, GM producers are still able to

[9] The importance of organic agriculture in the EU varies by country. In Austria, for example, where organic products are widely marketed by supermarket chains and organic farming is generously subsidized, surface under organic cultivation has a share of 18,5 %. In France, the respective percentage is only 2,5%. The EU average is 47% (http://www.organic-world.net/statistics-europe-production.html, accessed 15.11.2010).

distribute their harvests on the European market.[10]

INTERNATIONAL OUTCOMES: REGULATORY LEADERSHIP AND DEVELOPING WORLD REACTIONS

We have seen that the EU's regulatory policy evolution is driven by the countervailing requirements to accommodate domestic critique (by assuring a high level of consumer transparency and precaution and, more recently, to devolve decision-making power to member states), on the one hand, and to abide by global free trade disciplines on the other. As Skogstad notes, "Even while internal developments are the primary driving force behind policy innovations underway, these reforms are being designed to fit with the WTO model and thereby ward off trade retaliation" (2001: 498). However, the EU is not simply striving to adapt to international constraints, it is also a global policymaker seeking to align global rules and standards with its own legal framework.

This has been convincingly shown for the negotiations on the Biosafety Protocol. The Biosafety Protocol is the major international treaty in the context of the United Nations biosafety system. It was adopted in early 2000 as a supplement to the Convention on Biological Diversity to set up a binding framework that allows members to make informed decisions on the importing of GMOs. Although an environmental treaty, the Biosafety Protocol has major implications for international trade. In fact, these trade concerns, particularly among developing countries, constituted the major rationale to initiate negotiations on the Protocol in the mid-1990s (Falkner 2002: 4-5). Significantly, unlike WTO free trade rules, the Protocol enshrines the Precautionary Principle[11]; indeed, it can be interpreted as a precautionary instrument in itself as it is based on the mere assumption of potential dangers caused by modern biotechnology. This is at odds with WTO free trade rules, which require that potential dangers, which are used to justify trade restrictions, be scientifically demonstrated.

We observe that, in the late 1990s, "as the international context gained political salience in Europe and the negotiations became a test case for the EU's ability to withstand North American pressure" (Falkner 2007: 519), the EU changed from a laggard to a leader of the negotiations leading up to the Biosafety Protocol. Now, the Europeans desired stringent international rules which would lend

[10] EU countries' dependency on imported soy for animal feed is mainly due to the Blair House Agreement (1992), which set a ceiling on oilseed production in Europe to break the deadlock on negotiations on agriculture between the US and the EU in the Uruguay Round of the GATT (General Agreement on Tariffs and Trade).

[11] Principle 15 of the Rio Declaration formulates the precautionary approach (or principle) as follows: "Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation." The Biosafety Protocol refers to the PP in Articles 10 (6) and 11 (8), respectively.

legitimacy to the EU's own regulatory framework and establish principles conflicting with US regulations, such as the precautionary principle, rigorous labelling rules, and the mutual supportiveness of the Biosafety Protocol and WTO trade rules.

However, even though "a policy of regulatory export was at the centre of Europe's global leadership ambition" (ibid. 520), we note that this ambition does not go beyond the EU's domestic regulations. Falkner, for instance, demonstrated that the EU refused to extend its precautionary stance to areas that were considered less problematic within the EU, such as medical biotechnology. In the end, therefore, the region's systematic strategy to shape international regulation is circumscribed by economic self-interest.

In addition to making the EU a champion of labelling and precautionary regulations, the EU controversy also impacted on developing nations' biotechnology policies. As a general rule, trade considerations conditioned the ways in which developing country governments either embraced precautionary or liberal approaches. In an investigation of developing countries' policies to implement the biosafety protocol, Gupta and Falkner (2006), for example, found that China, due to an interest in favour of maintaining GM-free status, reinforced the shift towards more restrictive biosafety policies, whereas Mexico, under U.S. pressures for trade liberalization, followed the reverse trend. In a similar manner, Jennifer Clapp (2005) argues that interest in maintaining good trade relations with the EU were a key factor in various southern African governments' decisions to refuse U.S. food aid in the early 2000s.[12] The same author (2006) also identifies trade considerations as key shaping reactions to the unplanned exposure to GMOs—often referred to as "GM seed contamination"—in the Global South. Thus, whereas unplanned GMO imports in countries within the U.S. sphere of regulatory influence such as Mexico and Central America provoked weak government responses, African states in which trade and environmental interests converge adopted a strong policy stance.

Finally, the emergence of a European labelling regime also creates a complex dynamic in the production of and trade with agricultural goods in agro-exporting countries. Brazil is a case in point. After years of hesitation, in 2003 Brazil legalised the cultivation of GM soy. However, within Brazil the genetic technology was not embraced in a uniform manner. During a legal moratorium from 1998 to 2003 contraband soybeans illegally entered Brazilian agriculture, while state and federal governments competed for regulatory authority. In 2003, when the administration of Luiz Inácio da Silva lifted the moratorium, several states in the South had provisions in place to establish GM-free zones, for

[12] In 2002, several southern African countries refused to accept the GM food aid from the U.S., partly for sanitary reasons and partly to avoid contamination of their own crops, thus hurting potential future exports to Europe. A number of the countries eventually accepted the food aid provided it was milled first, but Zambia continued to refuse even the milled maize. In the ensuing polemic, the U.S. blamed Europe's moratorium on imports of GM foods for contributing to hunger in southern Africa.

example *Rio Grande do Sul*, or the state of *Paraná,* who declared to bank on GM-free production. These commercially motivated initiatives mark the expansion of the current European debate on coexistence and GM-free zones beyond Europe (Jepson et al. 2008: 224-227; Herring 2007: 140-145).

DISCUSSION: RADICAL CHANGE OR ECOLOGICAL MODERNIZATION?

The backlash against agri-biotechnology was one of the most prominent, and possibly effectual techno-environmental movements, in past decades. Agri-biotechnology is often acclaimed as a technological breakthrough that revolutionizes crop and food production and, just as vehemently, denounced for carrying unknown risks, reinforcing corporate power and aggravating economic dependencies. This essay's point of departure was that the controversy over the new productivity-enhancing technology, with its vibrant centre in the EU, must have considerably irritated the technology's budding trajectory. The central question it considers is what this irritation means for global sustainability or, to use a more common term, sustainable development.

The preceding paragraphs rendered sketches of two processes that are key to an understanding of these implications: firstly, the developmental logic of agri-biotechnology on a global scale, and secondly, the course, the domestic and international outcomes and the underlying logic of the EU's response to this logic. To conclude, I will summarize the general consequences of the GM controversy as they are revealed in three dimensions: the economic dimension, i.e., markets and industry strategies; the regulatory domain; and in the realm of discourse and critical movements, which are instigators and carriers of this discourse.

Before arriving at this discussion, I must return once more to the definition of sustainability. As pointed out in the introduction, sustainability is a political term, i.e., widely consensual in terms of being stated as an objective, but contested when it comes to the issue of designing and implementing policy measures supposed to promote sustainability. In other words, sustainability can mean very different things to different people. Therefore, in order not to end up in arbitrariness, I propose a juxtaposition of two versions of sustainability, or two alternative lenses through which the empirical process can be examined. For the purpose at hand, I distinguish an "ecological modernization" model and a "radical change" model of sustainability.

Like sustainable development, ecological modernization is a major concept that underlies environmental policy making in the industrial North and increasingly also in the developing world. A heterogeneous corpus of literature trades under the header of ecological modernization,[13] but here the term is used merely as a

[13] In the academic literature, ecological modernization has an ambiguous status. Some authors and policy practitioners adopt it as a normative standpoint or policy framework (e.g., Jänicke 1988), while to others it serves as a social theory for explaining that framework (e.g., Hajer

broad tag to denote a particular approach to sustainability policies adopted by governments around the world as well as in international environmental negotiations. In key respects the concepts of sustainable development and ecological modernization coincide, while in others, such as their content and scope, they differ. Ecological modernization is more specific than sustainable development; the former recommends and analyses changes in environmental policy making mostly in industrialized countries, while the latter promotes a vision for global development. In other aspects they converge. For instance, both sustainable development and ecological modernization are ideological and political concepts that cannot be narrowed down to the analysis of environmental policy making. Most important, similarly to sustainable development, which suggests a mutually reinforcing relationship between coping with the environmental crisis and promoting economic development, ecological modernization states that economic development and environmental policy are linked through a "positive-sum game." Suggesting a "win-win" relationship between the economy and the environment and focusing on the efficacy of technical fixes to environmental problems, ecological modernization does not challenge the mechanisms operating in advanced market societies or the power structures governing them. Rather, it argues that only through a socio-economic system like the present one—marked by the multinational operation of large-scale industries, competitive technological innovation, global markets and property rights, consumerism, productivist agriculture and food production, and urbanisation—can wealth creation and ecological sustainability be reconciled. In brief, ecological modernization does not call for any significant changes in corporate, public or political values, rules and power relations, but banks on the capacity of capitalist markets, technology innovators and the political institutions and decisional principles in power to cope with the environmental crisis. Consequently, ecological modernization is the common approach to sustainability policies among decision-makers in both industry and governments.

By contrast, from the vantage point of what here shall be called radical change position, a sustainability strategy such as ecological modernization is insufficient and even part of the problem. The radical change perspective points at the tacit premises and blind spots of hegemonic accounts of sustainability and ecological modernization (Brand 2010). It criticizes, for example, the fact that these approaches regard economic growth and free trade as the basis for sustainable development, and thus ignore the dramatic social costs of neo-liberal modernization; it rejects the premise that ecological modernization relies on expert knowledge and managerial elites, sanctioned by state authority, and thus marginalizes local accounts of reality; it does not share the belief of ecological

1995). Ecological modernization is not a unified concept regarding the radicalness of its claims to policy makers. Christoff, for example, introduced the distinction between "weak" and "strong" ecological modernization (1996), and Hajer distinguishes between "technocratic" and "deliberative" accounts of ecological modernization (1995).

modernization in the capacity of technological innovation to deal with complex social and environmental problems, which obscures the true socio-economic causes of sustained ecological and social misery (e.g., see Ribeiro and Shand 2008). A radical change approach also refuses that only national states and thus "national interests" are allowed into international negotiations dealing with the ecological crisis, and it disapproves of the pattern the outcomes that these negotiations commonly follow, i.e., the "valorisation" of "natural goods" functioning as a basis to strike ecological "deals" between national and socio-economic interests (Brand 2010).

In brief, the radical change perspective considers the hegemonic logic of mass consumption, capital accumulation, commodification, and global market expansion to be at the core of the current socio-economic crisis, rather than as a prerequisite for its solution. Consequently, it calls for fundamental changes in lifestyles, the global economy and power structures. Radical change perspectives are promoted by few—but often vocal—segments within the environmental movement.[14] They find expression in theoretical approaches like "de-growth" (e.g., Latouche 2006)[15] or the critical ecological discourse endorsed by voices within the global justice movement (e.g., Stedile 2004: 43, 44-45). Specifically, peasants and farmers who stand up for an agro-ecological approach and rally under the banner of the alter-globalization peasant association *Vía Campesina* advance a radical change perspective (Desmarais 2007). The concept of food sovereignty promoted by the *Vía Campesina*, for example, suggests the restriction of food production and consumption locally, which would favour small scale agriculture, local consumption and a rollback of intensive agriculture and international trade in food products (e.g., Harcourt 2008). By all means, it would require a radical change in lifestyles in the developed world and the lifestyle aspirations in the Global South. Within the global anti-GMO movement, defenders of radical change are among the most committed and vocal, such as the French *Confédération Paysanne* and the Brazilian *Movimento dos Trabalhadores Rurais Sem Terra* (MST).

In the following sections, I return to the global controversy around agri-biotechnology with these two evaluative perspectives in mind. More precisely, I analyse the global ramifications of the EU controversy in three dimensions: firstly, markets and industry rationales; secondly, regulations and policies; thirdly, public discourse and movement rationales.

[14] Indeed, radical change perspectives were part and parcel of ecological thinking in the origins of the Western environmental movement in the 1960s and 1970s. However, from the 1980s onward, these early ideologies gave way to more pragmatic, professionalized approaches to environmental policy, "culminating in a massive surrender to ecological modernization" (Van der Heijden 1999: 203).

[15] De-growth (French: *décroissance*) thinking identifies over-consumption and over-production as main causes of the current ecological and crisis and global social inequalities and thus argues for the downscaling of production and consumption.

MARKETS AND INDUSTRY: INERTIA AND ECOLOGICAL MODERNIZATION

The most obvious consequence of the public controversy in the EU is that labelled GM food products are very hard to find on European supermarket shelves.[16] As discussed, the reason why consumers rarely find labeled products in spite of strict labelling requirements is that the retail and food industries want to avoid damage to their image and expect these products to fail on the market. For the same reason, farmers in Germany and France opted against cultivating GM crops in the few years before the commercial cultivation of GM crops—only the maize variety MON 810—came under national safeguard bans in these countries. Those who nevertheless ventured into GM maize cultivation regularly became targets of local mobbing campaigns. Today, Spain is the only EU member country where GMO cultivation takes place. Furthermore, a great number of GM-free labels emerged that coincided with organic food products.

Given these facts, one might conclude that the European consumer market has shut down to agri-biotechnology products, but wrongly so. EU member states still import massive amounts of GM-soy, the major portion of which is being processed into animal feed.[17] The EU thus remains largely integrated into the global trade with GM commodities. The big agro-exporting countries are somewhat compensated for the economic loss resulting from the EU de facto moratorium and inaccessible European food markets, which certainly has some bearing on their reluctance to proceed attacking the EU regulatory system through the WTO legal system.

In sum, European opposition to agri-biotechnology has been successfully translated into the language of the market, as is the case with product labelling or the promotion of GM-free labels, which are mostly synonymous with organic farming. Economic developments in response to the biotechnology backlash in Europe therefore fall into the category of ecologic modernization.

The European backlash had direct repercussions in production systems beyond Europe, too. Brazilian initiatives to establish GM-free zones, even GM-free states, are a case in point. Again, these regional initiatives in one of the world's major soybean producers fall into the category of ecological modernization rather than radical change. They do not envision, for instance, a general cut in the production of soybeans destined to be used as animal feed, which, from a radical change

[16] This holds for most countries. A market survey found only a handful of products in a few countries: 27 in the Czech Republic, 18 the Netherlands, and 19 in Estonia. Individual products were on the shelves in Spain (6), the UK (3) and Poland (1). No products with GM labelling were found in the big supermarket chains in the rest of countries included in the survey: Germany, Sweden, Greece and Slovenia. In the UK, France and Germany, all big retailers and discounters apply the policy of selling only food products without GM constituents that are subject to labelling (GMO-Compass 2008)

[17] EU member states annually import approximately 40 million tons of raw soy products from the world's leading soybean producers Brazil, the U.S., and Argentina. According to estimates, 60 to 90 percent of world soybean exports come from GM plants (GMO compass 2006).

perspective, would represent the ecologically appropriate step.[18] Rather, these initiatives constitute trade strategies responding to a diversifying global agro-commodity market.

Finally, in the economic dimension, bio-industry rationales need to be considered. As has been illustrated, the revolt against GM food has neither altered the composition of GM commodities that are currently globally traded, nor has it changed corporate innovators' technological trajectory, such as bringing forward less profit-oriented innovation strategies.[19] With regards to corporate strategies, which proved largely unaffected by the European backlash, changes in the economic realm have therefore not even occurred.

REGULATIONS AND POLICIES: INERTIA AND ECOLOGICAL MODERNIZATION

Probably the most outstanding impact of the European controversy is the EU's regulatory reform, which was accomplished in the years of the moratorium under pressure from critical member states. With its weighty risk assessment and approval procedures, the recognition of the precautionary principle, and its traceability and labelling regime, the EU biotechnology regulation is certainly the most restrictive in the world. Nevertheless, as the WTO case made clear, even this regulatory system has been designed not to interfere with international free trade rules. Furthermore, since the approval machinery resumed operation in 2004, the Commission was eager to bring the EU's domestic situation back in line with WTO prescriptions. Backed by the EFSA, the Commission persistently pressed new GM products into the European market, often against the will of critical member states. The current reform efforts, the outcome of which is still uncertain, intend to hand back some measure of discretion over GM crop cultivation to member states and thus restore the democratic legitimacy of the EU approval process.

Again, these measures are variants of ecological modernization, since they are embedded into prevailing, market-dominated value and rule systems. They occur within a liberal framework, ensuring that product safety remains an essential state responsibility. Raising safety standards is thus the logical step taken by regulatory authorities in coping with a crisis of legitimacy, and even the strictest labelling regime leaves the logic of the market intact. Indeed, in this case, it creates a new market: the market for GM-free products. After all, it is the recognition of the right of GM-free producers—i.e., economic actors—to pursue

[18] On the socially and ecologically devastating consequences of rampant soybean cultivation in Latin America, see Gudynas (2008).

[19] In the long term, the European consumer backlash appears not to have affected corporate benefits substantially. Thus, in the course of the 2000s Monsanto's economic profit grew up to $1.3 billion in 2009. Only in 2010, due to the economic downturn, did profits fall below $900 million (Donlon 2010). In the same year, the business magazine Forbes named Monsanto company of the year, and the magazine Chief Executive dignified Monsanto chairman Hugh Grant as CEO of the year.

their business that gave rise to the EU's coexistence policy. The most recent development, the ongoing reform on the devolution of decision-making power to member states, cannot be pigeonholed as either ecological modernization or radical change. What can be said is that the reform will result in some kind of procedural change that is intended to end the constantly de-legitimizing conduct of GMO approvals in the EU. The sole motive of this reform is thus to pacify internal tensions, not to arrive at a more sustainable product policy.

In the international regulatory arena, not only did the EU successfully distinguish its own regime, based on precaution and product labelling, against the liberal, science-based approach of the U.S., but it also actively promoted its regulatory standards and principles. This did not have any effect on the U.S. system and regulations in like-minded states. This has been demonstrated with the study on countries' regulatory reactions on unplanned GMO imports: countries within the U.S. sphere of regulatory influence, mostly in Latin America, showed weak responses, while African states, desiring to keep their close trade ties with the EU, reacted strongly. However, to the extent that the EU's efforts to export its precautionary credo resonated with the rest of the world—mostly by way of the biosafety-protocol—we must still conclude that such stimulated regulatory changes do not reach beyond the scope of ecological modernization. Even though the EU added a counterweight to U.S.-domination, emerging more precautionary and consumer-oriented international and national regulations still remain embedded in a body of free trade law adjudicated by the WTO.

MOVEMENTS AND PUBLIC DISCOURSE: AWARENESS RAISING AND ECO-POPULISM

The fact that, in the past four decades, the ecology has been consolidated as key policy field both in the international and in national domains is, to a large extent, owed to the incessant activity of the environmental movement and its shaping of public attitudes. Movement agency and public discourse are causally linked: movement actors' key instrument to influence the political process is public communication, and its key resources are public attention, credibility and resonance. Not only may tangible policy outcomes result from this—albeit hardly ever clearly traceable to movement impulses—but changes in public perception and discourse are achievements of movement activities in their own right, as they provide the context for further movements, public debates and policy responses.

The GM controversy has stirred considerable public debate in and beyond Europe. It is not possible here, nor is it the objective of this section, to give a complete account of this debate (e.g., see Bauer and Gaskell 2002). Regarding its policy impact, the cases of France, Germany and Spain outlined before have demonstrated that movement intensity, public resonance and state responsiveness are positively interrelated. The anti-biotech movement has thus impacted on the policy process. How far reaching the changes in the economic

and regulatory domains are has been outlined above, but the exact extent to which they were induced by the anti-biotech movement remains to be determined.

Movement discourse is a two-sided matter. On the one hand, we note that criticism, while highly instrumental in its quest to obstruct the agricultural technology, is more complex and multifaceted than the reiteration of alleged health or ecological risks of particular GM commodities—a recurrent feature of movement discourse—might suggest. Movement discourse draws public attention to all the background concerns, too, such as the downsides of intensive agriculture, global trade in food products, or intellectual property rights in the seed industry. It thus takes the debate much further, beyond matters narrowly related to biotechnology, to a general social critique that denounces the "juggernaut" of modernization and capitalist globalization, and insists that "another world is possible" (Giddens). Along with the anti-biotechnology discourse, therefore, go alternative concepts like organic agriculture, de-growth, or food sovereignty. This kind of critique clearly goes beyond the pragmatic remedies of ecological modernization to call for radical changes in power structures and productive systems. Its social mirror image is the global justice movement which, in the late 1990s, entered into synergy with parts of the anti-biotechnology movement. The actor structure in these henceforth cross-cutting movements benefited from the creation of far-reaching networks crossing national, and even continental, boundaries.[20] This merging helped to make known to the broader Western public the previously little-known initiatives tackling pressing socio-ecological grievances such as the international farmers association *Vía Campesina*.

However, there is an aspect of movement discourse that remains rather problematical. Even authors critical of agri-biotechnology have found it to follow an "eco-populist tendency" (Wield et al. 2010: 343). Such an observation accords with the social logic of movement discourse, as mentioned before. With public communication being the key device in any movement's political toolbox, movements struggling to shift public opinion inevitably fall back on discursively promoting recognizable contrasts and polarizing stereotypes. The movement discourse on agri-biotechnology offers some illustrations. One is the narrowed-down vision of alternatives to agri-biotechnology it brought about. Lockie (2006), for example, observes that the public controversy has resulted in a binary opposition set up between agri-biotechnology—equalling artificial,

[20] How the creation of trans-national movement networks and the issue-linkage of a critique of biotechnology and neo-liberal globalization are interrelated is illustrated by an episode that took place around the World Social Forum in Porto Alegre in January 2001. After the French farming activist José Bové, together with around thousand MST activists, took part in the destruction of a soya crop on Monsanto premises, he was taken into police custody and given 24 hours to leave the country. The following legal appeal, press conference and the wave of solidarity among the thousands of participants and prominent activist leaders attracted considerable international media attention (Bellos 2001, Caramel and Sevilla 2001).

threatening and untrustworthy agriculture—and organic food, which is seen as synonymous with safety, naturalness and nutrition. Alternatives to intensive agriculture beyond organic farming are thus withdrawn from public perception.[21]

Another case in point is the movement doctrine, according to which biotechnology disadvantages resource-poor farmers in developing countries. In this scenario, farmers have no potential for income improvement for any family farm whatsoever, corporate control is reinforced, and all profits are allotted to an elite club of multi-national, agro-chemical corporations. However, evidence indicates that this picture is far from doing justice to the much more complex, patchy and inconclusive dynamic on the ground. Whereas self-congratulatory industry declarations such as "farmers around the world have voted with their plows" (Donlon 2010) should be taken with a pinch of salt, a series of episodes illustrate that medium and small farmers in developing countries turn to bioengineered crops when this is in their interest, and do so to their advantage (Herring 2007; see Tripp 2009 for the case of transgenic cotton in particular).[22]

Finally, movement discourse unnecessarily constricts developmental perspectives in denying agri-biotechnology any potential to design crops tailored to the needs of the poor. Although the entire range of current first generation products results from the private sector's yield-maximizing strategies, as has been outlined before, developmental capacities in international public sector research institutions are growing, too. The current wholesale rejection of agri-biotechnology will leave movements no choice other than to militate against possible products that would make sense from a sustainability perspective.[23]

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[21] "By linking food scares to a simplified binary between the organic/natural and the GE/agro-industrial, media-based discourses on food and sustainability were created and reproduced so that the multiple approaches taken by agriculturalists to the pursuit of sustainability and food quality were largely invisible. Relatively little media discussion of food, therefore, might have been seen to promote improved public understanding of agriculture and environmental issues. This has obvious implications for those promoting conservation farming, integrated pest management, whole farm planning, or any of a host of other non-organic and non-biotech agrienvironmental measures. Whatever their particular agroecological merits or appeal to farmers, existing media discourses would do little to help create market values and incentives for food produced using these practices" (Lockie 2006: 321).

[22] Exemplary are what Herring calls "stealth seeds," i.e., GM seeds that are illegally appropriated, cross-bred, exchanged and planted among farmers in Brazil and India. Ironically, these forms of underground diffusion of GM seeds not only undermine precautionary biosafety rules, but also corporate property rights (Herring 2007).

[23] Probably the most outspoken rejection of the proposition that, in principle, the creation of useful GM crop plants is possible came from the radical French anti-biotechnology movement. Early in their campaign, activists deliberately attacked field trials conducted by public research institutions such as the CIRAD (*Centre de coopération internationale en recherche agronomique pour le développement*) with a mission to develop agricultural techniques meeting the needs of the rural South. The continuing direct action campaign against field trials later prompted state authorities to organize an official public debate on the legitimacy of field trials. What emerged

CONCLUSION

In view of our initial assumption that the European anti-biotechnology movement was one of the most striking and—from its proponents' point of view—successful movements in past decades, the analysis of its broad consequences seem rather sobering. While it is true that the controversy's consequences are so far reaching that they can be traced in economic and regulatory realms around the world, none of these consequences marks a significant rupture with the rules and values of a global system operating on the basis of expansive mass consumption, global trade and financial capitalism, soaring energy throughput, industrialism and agricultural productivism. In key domains the controversy did not have any substantial impact at all. This, for example, holds for the developmental trajectories of the agrochemical industry, still the only maker of globally traded GM crops. One could have expected that private innovators, under pressure from citizens, retailers, consumers and states, revise their product strategies. They have not. Similarly, the liberal, science-based regulatory framework of the U.S. and its satellite block of agro-exporting countries has not undergone any precautionary or consumer-oriented reforms (with the notable exception of some Brazilian states).

If change occurred, it represents some variant of ecological modernization—at least in the sense that they readily blended in prevailing economic and political institutions. Thus, European consumer markets have shut out GM foods but, because of Europe's demand for animal feedstuff rich in proteins, the EU remains fully integrated in global trade with GM soy. The EU provides for strict labelling and recognizes the right of GM free producers, especially organic farmers, but this recognition is based on the EU's fixation on the market principle and EU integration through the common market respectively. On the international plane, the EU has asserted and promoted its precautionary and consumer-oriented regulation, but with great caution not to interfere with WTO regulations. Some developing countries have followed suit and adopted policies and production strategies matched with European demands, but with great care to set these steps in harmony with market considerations and free trade rules.

If disillusioning from a radical position, the fact that ecologic modernization turns out to be the principal reform mode in the wake of the biotechnology controversy will not dissatisfy proponents of pragmatic, problem-focused solutions who either do not question the capacity of a market-driven, industrial society to find its way to sustainability or simply deem the chances for a historic transformation of industrial-capitalistic world-society unrealistic.

Indeed, the prevalence of ecologic modernization is hardly surprising. It is hard to imagine that a controversy over a single technology seriously challenges a

from the debate was the distinction between those dispensable commercial and legitimate scientific field trials (Kempf 2002).

global system that is deeply entrenched in the global political economy and the globally aspired consumerist lifestyle. (It would come as a paradox, indeed, if a movement, the major allies of which are European consumers and a European middle class endowed with the purchasing power required to create demand for GM-free products, succeeded in seriously challenging the consumerist lifestyle.) The fact that a technology largely shaped by corporate profit-maximizing imperatives has been placed under precautionary reserve in some parts of the world has thus come to be regarded as the major outcome of the controversy from the substantial perspective.

From the discursive perspective, its achievement was to encourage related movements and stir debate on issues that exceed the technology and touch upon various aspects of global justice and sustainability. Thus it connects and empowers actor groups scattered over the globe who promote and—as do various peasant associations such as the MST and the *Confédération Paysanne*—practise ways of life and work which, indeed, inaugurate a radical move towards sustainability. These rural movements, running against the stream of global max-output capitalism, might remain at the margins of global development in the future, but today, they stand as living examples that alternatives are possible, and indeed, feasible. In the publics of the industrial North, in turn, the radical change model finds its way into the mass media to launch its challenge to industrial society from there. If chances are dim that the discourse of radical change (which has been voiced—and even more audibly—from the early years of environmental movement on) will turn lifestyles and policies around, its sermons take the place of a collective bad conscience: they serve as a reminder to middle classes that the industrial society's manifold attempts to reconcile wasteful living standards with ecological norms are a sustained delusion rather than solutions for sustainability.

Yet again, the popular anti-biotechnology narrative comes at a cost, too. With public development capacities around the world building up, we have reasons to hope that, one day, modern agri-biotechnology will make a contribution with products tailored to the needs of the poor. These products will not be magic bullets (except if you believe in magic), and they certainly won't mitigate the more pressing social questions surrounding food, such as international trade regimes, land distribution and rural policies, but they might make a contribution. (In fact, previously quoted evidence indicates that even some currently traded GM products do so for certain groups of small farmers under certain circumstances.) So far, however, the eco-populist black-and-white contrast, unremittingly upheld by movements to hamper the technology, has done little to steer its development into more sustainable waters or to prepare the ground for such products. It remains to be seen how the movement will cope with this programmatic challenge.

Notwithstanding the ambiguity of this analysis, which is fraught with unknowns and normative uncertainty, a final, purely speculative, reflection may lead us to a more conciliatory balance after all. What the controversy over agri-

biotechnology definitely brought about is diversity: diversity in regulatory principles, from the global level downwards; diversity in food products and production systems; and diversity in symbols and ways of thinking about the future of food, agriculture, trade, technology, nature, and our way of life. It is a commonplace that evolution needs diversity, for diversity enhances the survival chances of a species—indeed, evolution is a prerequisite for its survival. Diversity certainly has a comparable meaning for our species, not necessarily in terms of biological diversity, as humans survive (and proliferate) by ways and cultural evolution, but in terms of economic, technological and political differences. In this regard, this and related controversies, all irritations of a predominant, highly dubious developmental path, have rather increased than diminished our options for survival, and almost certainly have contributed to our sustainable development.

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