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Sustainable Development as Ecological Modernisation: Explaining EU Policy Conflicts over Agbiotech

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Les Levidow[1] and David Toke[2]

Contacts for correspondence:
1 Development Policy and Practice, Open University
Milton Keynes MK7 6AA, email L.Levidow@open.ac.uk

2 Department of Sociology, University of Birmingham B15 2TT, email d.toke@bham.ac.uk

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Abstract

European Commission policy has promoted agbiotech in the name of 'sustainable agriculture', based on the industry's claims for ecoefficiency improvements. The Commission has aimed to facilitate approval and commercialisation of GM products, as a means 'to complete the internal market'; this project became linked with neoliberal globalisation, whereby the objective imperatives of economic competitiveness force Europe to adopt agbiotech. This linkage provided a vulnerable target for political protest against agbiotech as a symbol of neoliberal policies. Societal conflict was eventually translated into regulatory disputes over the appropriate safety standards for GM products. These disputes, combined with a retailers' boycott of GM grain, largely blocked the European commercial development of agbiotech.

Those EU conflicts provide a case study for evaluating the explanatory utility of ecological modernisation (EM) as a social theory. Some EM perspectives can help to explain how eco-efficiency claims framed agbiotech innovations, gained wider policy support and provoked demands for more stringent regulation. However, those EM perspectives have limited capacity for explaining the societal conflicts and their outcomes. These limitations derive from normative standpoints: attributing environmental degradation to market failure, understanding 'eco-efficiency' as an input-output efficiency of resource usage, understanding pollution in narrowly biophysical terms, and modelling civil society as supporters of such efficiency improvements.

Going beyond those limitations, some EM perspectives have already been linked with wider ones: state failure, cultural-discursive frames, rival political economies and reflexive policymaking. These perspectives too have normative standpoints, which enhance the analytical utility for explaining the EU societal conflict over agbiotech. Normative differences among theories cast a new light upon the task of linking EM with other analytical perspectives.

1 Introduction

In the last couple decades, 'sustainable development' (SD) has become a common reference point for policy frameworks linking environmental, economic and social issues. Originating in debates on North-South relations, the SD concept has been extended to Western industrial nations, even becoming a mainstream discourse in European policy. Consequently, SD has had competing accounts, whereby the same development trajectory is promoted as 'sustainable' or is attacked as the contrary.

In parallel, ecological modernisation (EM) literature has sought to explain policies linking environmental and economic improvement. Some policies are officially called 'sustainable development'. Explicitly or implicitly, academic writings have favoured specific policy frameworks in the name of SD and/or EM. Such linkages may bear upon about the status of EM as theory – its utility for explaining the dynamics of government policy and industrial change.

As a case exemplifying all those issues, agricultural biotechnology (henceforth 'agbiotech' for short) has been promoted in the name of 'sustainable agriculture', especially by the European Commission. Its policy has generated intense conflict, eventually creating a crisis of EU decision-making procedures for agbiotech products. This sector may seem marginal to EM theory, which has focused on pollution problems in heavy industry and solutions in clean technology. Yet agbiotech has been promoted in such terms for solving the pollution problems of intensive agriculture, so the sector is arguably relevant.

Amidst the EU-wide conflicts and policy changes over agbiotech, the European Commission has led efforts to set and achieve EU objectives, so it warrants a special focus for analysis. Academic analyses have referred to EM in various ways, perhaps reflecting ambiguity about EM as theory. So its meaning warrants clarification in relation to this case.

This paper has three main aims:

- to explain the origins and outcome of European Commission policy towards agbiotech, as a case study to evaluate strengths and limitations of ecological modernisation (EM) theory;
- to identify other perspectives which can address those limitations; and
- to judge how normative standpoints of the various perspectives enhance and/or limit their explanatory utility.

To pursue those aims, this article has the following sequence of sections: ecological modernisation (EM) as a social theory; how EM relates to the general development policy of the European Commission; its early policy on agbiotech; the agbiotech controversy that emerged in the 1990s; and how the Commission dealt with the ensuing difficulties. The conclusion reflects on implications for EM as theory.

Sources and methods

For its information sources and research methods, this paper draws mainly upon two EU-wide research projects on the regulation of agbiotech (see Acknowledgements section). At the EU and national level in several member states, the projects were carried out during 1997-1999 and 2002-04, respectively. Each project analysed publicly available documents from government, industry, farmers' organisations and NGOs. Such documents encompassed general policy issues, risk regulation and GM labelling criteria.

The documents also provided a basis for semi-structured interviews with key policy actors from the same organisations. At the EU level, for example, interviewees included staff responsible for agbiotech policy issues at the European Commission (several Directorates-General), EuropaBio, European Parliament, FoEE, Greenpeace and the European Environmental Bureau.

This paper draws upon analyses already carried out from those research projects. It includes just a few citations selected from original sources, supplemented by citations from EC policy statements.

2 Ecological modernisation as theory: analytical and/or normative?

In the academic literature, ecological modernisation (EM) has had an ambiguous, even inconsistent status – as a normative standpoint, as a policy framework, and/or as a social theory for explaining that framework. Ambiguities arise in at least two ways. First, academic literature often uses the term as if it could have any or all of those meanings, though EM per se rarely appears in policy documents. Second, authors explicitly favour or presume a specific policy framework through normative standpoints, thus linking EM (or a variant) with accounts of societal progress. In such ways, EM has been effectively elaborated as both an analytical and normative concept.

Why does this combination matter? According to a critical survey of the literature, EM accepts 'the implicit belief in science, technology and progress so characteristic of modernity'. Alongside that belief, 'At another level, there is also an inclination to interpret this term as both analytical and normative: as what should take place if the environment is to be saved (Seippel, 2000: 292). Writers sometime distinguish between analytical versus normative aspects of EM, yet each perspective combines both aspects, according to another survey (Milanez and Bührs, 2007: 580).

Links between normative and descriptive aspects of EM can strengthen its social utility, according to Arthur Mol:

> According to me, the valuable and more profound contributions to ecological modernization are exactly those that relate the analytical/descriptive qualities with normative trajectories. In other words: ecological modernization tries to build normative reform programs on the basis of (an analysis of) actual transformations in institutions and social practices (Mol, 1999: 176).
> .

He suggests that those aspects are complementary but separable:

> In essence, ecological modernization theory can thus be seen as an analytical or interpretative framework that helps to understand contemporary environmental reform dynamics. Similar to most social theories, whether these are (neo-) Marxist analyses or post-structuralist interpretation schemes, ecological modernization theorists often complement their analytical perspective with a normative or prescriptive outlook on the desired or feasible paths towards sustainable development (Mol, 1999: 171).

Are the normative aspects merely complementary – or integral to the status of EM as theory? In various ways, EM perspectives incorporate societal norms into explanatory accounts and prognoses of environmental improvement. The survey below traces those links in each author cited, rather than presume a distinction between normative and analytical aspects. The normative ambiguity and standpoints of EM will be taken up again when evaluating its explanatory utility.

2.1 'Sustainable development' as resource-efficiency

EM has sought to explain and promote policy changes which integrate economic with environmental criteria. According to the sociologist Joseph Huber, ecological problems arise from the industrial techno-system colonising the socio-sphere and eco-sphere. In his view, the remedy lies in an eco-social restructuring of the techno-system: 'the dirty and ugly industrial caterpillar will transform into a[n] ecological butterfly' (Huber, 1985: 20; cited in Mol, 1995: 37; also see Mol, 1996: 312-13). More recently, he has noted a conflict between environmentalist agendas: large-scale industry promotes an 'efficiency revolution', while anti-modernists counterpose the 'sufficiency' principle. The limitations of both can be overcome through 'industrial ecology' by developing technological improvements, he argues (Huber, 2000).

Such improvements have been seen as overcoming the perceived conflict between economy and ecology –theorised as interdependent features of innovation. EM theory emphasises the potential for re-embedding an ecological dimension of economic practices within modernist institutions, by institutionalising ecology in production and consumption processes. This could be done through government measures stimulating self-regulation of industry, thus transferring responsibilities from the state to the market (Mol, 1996: 306). This focus abandoned or rejected any diagnosis of state failure to direct innovation along environmentally more benign pathways. Instead EM focused on market failures, thus narrowing the potential roles for the state, as if no wider role was necessary or even thinkable.

In the development of EM concepts,

> The first contributions, especially those by Huber (1982, 1985, 1991), were characterized by a heavy emphasis on the role of technological innovations in bringing about environmental reforms, especially in the sphere of industrial production; a rather critical attitude towards the (bureaucratic and inefficient) state, also shared by the early writings of Jänicke (1986), a very favourable – if not naïve – attitude towards market actors and market dynamics in environmental reforms (later glorified by neo-liberal scholars); a system theory perspective with a relatively underdeveloped notion of human agency and social struggles; and an orientation to the nation state level (Mol, 1999: 169).

According to some EM accounts, economic competition can be shaped in more ecologically sensitive ways through eco-efficiency improvements. EM depends on a corporatist-style management whereby governmental and business together plan attainment of environmental objectives through holistic, rational, re-regulation of market contexts. EM seeks to integrate environmental issues into all policy areas, while delinking economic growth from environmental stress. Thus it reframes business interests (Dryzek, 1997).

In those ways, EM perspectives challenged prevalent features of 1970s environmental sociology. This had attributed environmental degradation to an intrinsic tendency of industrial capitalism, sometimes called a 'treadmill of production' which perpetually pollutes the environment and exhausts resources. As an alternative perspective, EM provided a means to conceptualise environmental improvements already underway or being promoted. 'Clean technology' denotes innovations motivated mainly by economic advantage, while also potentially reducing pollution, in innovative ways which go beyond simply control and abatement measures (Murphy and Gouldson, 2000).

According to more critical perspectives, EM theory makes assumptions which may limit its explanatory utility. Eco-efficiency gains are presumed to be achievable through super-industrialisation within capitalism (Buttel, 2000: 60), thus perhaps seeing only changes which fit that model. More fundamental limitations include: 'the preoccupation with efficiency and pollution control over broader concerns about aggregate resource consumption and its environmental impacts', and an uncritical stance towards the transformative potentials of modern capitalism (ibid: 64).

The transformative potential of capitalist modernisation is seen as benign, hindered mainly by market failure to provide incentives, thus warranting state assistance or incentives to correct the failure; by contrast, a diagnosis of state failure could warrant policies to direct innovation while engaging with civil society. 'Ecoefficiency' is reduced to an input-output efficiency of resource usage and pollution control; by contrast, broader concepts encompass ecological footprints, social equity, civil society empowerment, etc. Given such limitations, EM's utility as a theory will depend upon its integration with political-sociological perspectives on relations between the state, society and industry, argues Buttel (2000).

The Anglo-American academic debate has scrutinised early EM perspectives emphasising market failure and resource-efficiency, while downplaying other early EM perspectives which have different normative standpoints. Analysing political changes since the mid-20th century, Martin Jänicke diagnoses a problem of state failure to promote a humane industrial development. State failure means 'the inability of government reform policies to replace the

outmoded post-war pattern of industrialism' (Jänicke, 1990: x). The market does not consider ecological degradation, and the state fails to control the market; governments develop a close relationship with powerful lobbying groups, and public institutions fail to hold bureaucracies accountable. This is a problem of political power, rather than a technical problem. Citizens should exploit economic and environmental crises in order to build a countervailing power, argues Jänicke (1990).

Another difficult theoretical issue is the social basis and role of reflexivity. EM illustrates and analyses reflexive modernity, which can internalise uncertainty about environmental effects, according to Mol. Institutionalisation of both ecology and doubt occur simultaneously, in mutually reinforcing ways. Environmental reform is often portrayed as apolitical – by emphasising economic actors, while putting wider societal actors between the brackets. Yet 'environmental reform proceeds only through social struggles and disputes, which are hardly found and rarely emphasised in ecological modernisation theory'. Given its preoccupation with an institutional analysis, EM has under-theorised the political and ideological aspects (Mol, 1996: 318-19).

2.2 Tensions among environmentalisms

Some authors distinguish between types of EM as if they were specific policy frameworks or processes. Explicit examples are distinctions between 'weak versus strong' EM (Christoff, 1996), or between 'technocratic versus deliberative' EM (Hajer, 1995), whereby the authors favour the latter version of each pair. Such preferences imply that the concept denotes types of policy frameworks, not simply a theory for analysing their socio-political dynamics.

While EM literature often takes for granted the claims for eco-efficient innovation, some perspectives question their role and meaning. Eco-efficiency discourses can promote specific techno-fixes, as if no other diagnosis were thinkable:

> [ecological modernisation] … uses the language of business and conceptualises environmental pollution as a matter of inefficiency, while operating within the boundaries of cost-effectiveness and administrative efficiency… [EM] is…basically a modernist and technocratic approach to the environment that suggests that there is a techno-institutionalist fix for the present problems (Hajer 1995: 31-32)

EM can be linked to diverse policy agendas. In the above sense, EM is predominantly 'techno-corporatist', dependent upon agreements with industry for technological improvements (Hajer, 1995: 38, 281). At the same time, EM remains flexible; 'eco-efficiency' can accommodate neoliberal calls to restructure the economy for greater competitiveness, as well as radical environmentalist critiques of capitalism (ibid: 32-33).

Eco-efficiency has an ambiguous flexibility, as illustrated by Hajer's empirical case study of acid rain policy. In the Netherlands case, his analysis involves three main elements. Through a social accommodation, the Dutch system involved NGOs in discussing potential solutions. Through a discursive closure, governments adopted the apocalyptic language of NGOs – as a means to promote flue gas desulphurisation, an end-of-pipe remedy which pre-empted the need for structural change (ibid: 279). Through a problem closure, pre-empting technological choices, regulatory-fiscal criteria favoured 'clean' techno-solutions, even though they had doubtful environmental benefits by comparison to alternative options (Hajer, 1995: 266).

In the Netherlands these outcomes disappointed environmentalist aspirations for fundamental change in the industrial system, e.g. towards more decentralised, collective control over resources. As a techno-corporatist form of EM, the policy framework had little scope to accommodate such environmentalist demands. Indeed, paradoxically, apocalyptic and eco-efficiency discourses were combined in ways which protected the industrial infrastructure from challenge.

Eco-modernist techno-fixes pose a challenge to environmental NGOs, which previously had close links with opposition movements, generally promoting structural change in society. Since

the 1980s, Western environmentalism has become professionalized and bureaucratised (Jamison, 2001). European NGOs have focused more narrowly on environmental quality and its improvement through technological change; they no longer regard industry as an obvious opponent. NGOs 'engage in constant dynamic processes of coalition building with rapidly changing opponents and partners…' They also focus on global economic and political processes. Through these shifts, they readily lose their grassroots links (Mol, 2000).

In that historical context, EM theory can help to illuminate tensions among environmentalist approaches. Often citizens protest against techno-fixes which make claims for environmental improvements, especially when linked with imperatives of economic competitiveness:

> … the late 1990s showed how citizens not so much opposed eco-modernist governmental policies but conceived of the environmental problem in different, more culturally loaded terms... Furthermore, governments could be seen to strengthen the ties between eco-modernist thinking and neo-liberal economic discourse… (Hajer and Versteeg, 2005: 179)

In this variant, EM theory can help to analyse how eco-modernist discourses are linked with specific policy agendas and cultural meanings which may drive societal conflict.

As a route beyond techno-institutional fixes, Hajer advocates 'reflexive ecological modernisation' featuring discursive practices, e.g. discussion of the social order in terms of 'what constitutes pollution'. He emphasises 'mobilisation of independent opinions versus the respected power of authorities'. Decision-making would involve wider civil society, rather than be left to technocratic experts working 'in relative quiet' (Hajer 1995: 281-82). He recommends the adoption of 'reflexive institutional arrangements' (ibid: 288-294) though he acknowledges that these could provide greater opportunity for social dissensus (ibid: 269).

As the author's normative preference, 'reflexive ecological modernisation' corresponds to no clear example in his empirical study. Nevertheless this concept highlights social norms in techno-institutionalist EM, as both a policy and theoretical framework. On this basis, Hajer's perspective can identify political tensions within the societal dynamics around an 'eco-efficient' innovation.

3 EC 'sustainable development' policy analysed as EM

In some theoretical accounts, EM has been variously contrasted or compared to sustainable development. The latter is clearly a policy concept, initially relating to the global South. For that reason, EM may be 'more useful than sustainable development as a macro or overarching framework for thinking about the environmental problems of metropolitan transformative industry in the North' (Buttel 2000: 63).

The two concepts differ in several respects. In contrast to EM, sustainable development involves social justice, both within and between generations. SD focuses on both global and national levels, whilst EM focuses mainly on the national. And SD evaluates 'carrying capacity', a concept largely absent in EM. In the name of SD, European environmental policy has become increasingly important and takes account of equity issues, both linked with economic development (Langhelle, 2000). Thus SD is normative in somewhat different ways and more explicit ways than EM. On this basis, appeals to SD can both shape and legitimise innovation trajectories.

When the European Commission promotes 'sustainable development', its policy more resembles EM. The policy has been analysed as follows:

> A commitment to a strategy of ecological modernisation as a central element of environmental policy involves a reordering of regulatory space in a search for a balance between market forces and government regulation of a new type. By creating the kind of regulated market described above, the objectives of sustainable development are to be achieved by introducing considerations of environmental quality and care as parameters for the decisions of economic actors (Hanf, 1996: 219).

Early Commission policy foresaw the need for trade-offs between environmental protection and economic growth, though it also sought to integrate these aims. Already in 1982 the Third Environmental Action Programme (EAP) recognised that environmental protection could give Europe extra benefits of economic competitiveness. In 1992 the Fifth EAP explicitly saw environmental protection and economic growth were seen as complementary through greater ecoefficiency, so that 'sustainable development' would be good for business. According to the Director-General of DG-Environment in that period, an effective environmental policy would be necessary for industrial survival (cited in Weale 1992: 78).

Rather than prescribe specific innovations, Commission policy sought to establish partnerships and incentives to achieve common goals. According to the Director-General of DG-Environment in that period, this policy needed 'active participation of all socio-economic partners in the joint search for solutions for environmental problems and the realisation of sustainable development' (cited in Hanf 1996: 212). In 1999 the Council of Environment Ministers called for a long-term strategy 'dovetailing policies for economically, socially and ecologically development' before 2001 (ENDS, 2001). Those 'three pillars of sustainability' were framed as complementary, rather than as competing priorities which would require trade-offs.

Overall this policy has been interpreted as ecological modernisation, as in the following paraphrase: 'the market must ensure that environmentally friendly goods and services have a competitive advantage over those that cause pollution and waste' (Hanf 1996: 210). According to a similar analysis of Commission strategy, the future development of a post-industrial economy depends on a nation's capacity for high-quality, high-value products with stringent environmental standards enforced (Weale 1992: 77, 1993: 210). Although such links may not be consistently realised in practice, this discourse can be understood as a coalition-building device, especially for reconciling powerful economic interests with environmental protection, argues Weale (1993: 213).

Alongside those forms of 'sustainable development', EC policy also aimed to 'complete the internal market'. Avoiding distortions of competition, rather than preventing environmental degradation, was the main aim which provided extra opportunities for EU-level environmental legislation (Burchell and Lightfoot 2001: 36).

Within that framework, EU policymakers have taken divergent approaches. According to a prevalent neoliberal view, different national standards impeded trade and economic progress, so the Community should promote a mutual recognition of standards, in order to complete the internal market. According to another view, the internal market could bring products and environmental changes which are either positive or negative, so the Community should set standards which favour environmental improvement. The latter view appeared in some policy documents, but it was not easily adopted or implemented, for many reasons. DG-Environment had a weak role within the Commission, and environmental issues were readily subordinated to imperatives of economic competitiveness (Weale and Williams 1993).

As an ongoing tension, EU makes symbolic declarations on 'sustainable development' while adopting EM strategies, which are more compatible with the European integration project. '[EM] is in keeping with its key tenet, namely the construction of a neoliberal free-market economy in support of industrial competitiveness'. This linkage marks a shift from the social-democratic framework of the 1987 Brundtland report. Sustainable development is largely understood as market-based eco-efficiency measures decoupling economic growth from environmental harm. Nature is still framed as a 'standing reserve' of exploitable resources (Baker, 2007: 302-03).

Overall the EU policy discourse on sustainable development plays several roles. It enhances business opportunities through environmental issues, provides public reassurance, and forms a social identity that can legitimise the EU integration project. Despite its neoliberal framework, the EU's symbolic commitment to sustainable development has transformative potential for stimulating alternative changes: 'the struggle between sustainable development and ecological modernisation is a struggle over the future direction of Europe' (Baker, 2007: 313-14).

Agbiotech may seem an awkward case study for EM theory. GM crops are directed at a primary production sector, more akin to examples in the global South, with its explicit debates about sustainable development (Buttel 2000). However, agbiotech controversy has been analysed in terms of EM. Brazilian farmers have been cautious about openly using GM crops because any GM material may jeopardise their sales to EU markets, which seek non-GM grain for food purposes. Beyond those commercial motives, anti-agbiotech protest stimulated alternatives to agri-industrial production. On that basis, alternative agricultures in the global South can find broader allies seeking to protect export markets (Jepson et al. 2005: 307).

European agbiotech controversy has been analysed by using the EM concept in various ways. An early account linked EM with efforts at more stringent regulation of agbiotech (Gottweis, 1998: 232-35; see next section). By contrast, later accounts associated EM with pro-biotech agendas. In the UK, New Labour supported GM crops as a means to maintain an economic competitive advantage, while enhancing sustainability through more intensive, eco-efficient agri-production (Barry and Paterson, 2004). UK agbiotech supporters made claims for environmental advantages over conventional agriculture. Opposition groups rejected that framework along with industrial agriculture altogether, while appealing to natural characteristics of alternatives, especially organic farming (Toke, 2002, 2004).

As suggested by those analyses, different agri-environmental discourses may be linked with rival political economies. In that vein, European agriculture has been theorised as a 'battlefield' between an agri-industrial paradigm including agbiotech, versus an agrarian-based rural development developing alternatives (Marsden and Sonnino, 2005). Such alternatives have taken diverse forms across Europe; together they open up possibilities for 'alternative post-environmental strategies' (Buttel, 2005), e.g. by improving crops and cultivation methods through knowledge other than GM techniques.

The above analyses of agri-technological controversy feature explicit or implicit normative standpoints, generally favouring alternatives to the agri-industrial system and agbiotech. Those norms inform the analytical aspects by highlighting choices made by industry and government, rather than accept official accounts of eco-efficiency.

4 Commission agbiotech policy contested

4.1 Agbiotech promoted as eco-efficiency

In the 1980s the European Commission developed a new narrative on technology policy: European companies could not adequately compete in an increasingly global market, so they must be integrated into competitive multinational companies. For this economic aim, an essential tool would be the application of modern biotechnology to European agro-food industries. According to a key 1982 document, our 'Biosociety' increasingly depends on sustainable processes and recyclable products, especially of agriculture; modern biotechnology can extend our control over such processes. In this way, the Commission's problem-diagnosis promoted a specific future scenario favouring agbiotech (Gottweis 1998: 170).

Moreover, the Commission identified biotechnology as necessary to create wealth through more efficient innovations. In its 1993 White Paper on *Growth, Competitiveness, Employment*, the Commission advocated a 'clean technology' base, which would facilitate a positive relation between the environment and economic growth. Its policy also counselled European adaptation to inexorable competitive pressures: 'The pressure of the market-place is spreading and growing, obliging businesses to exploit every opportunity available to increase productivity and efficiency' (CEC 1993a: 92-93).

This imperative was linked with innovations such as biotechnology: 'The European Union must harness these new technologies at the core of the knowledge-based economy' (ibid: 7). It conflated traditional biological methods with genetic modification, as essential tools for the future: the entire agro-food industry became discursively 'based on biotechnology', i.e. economically dependent upon the products of genetic modification (ibid: 100-103). Thus

technological determinism was linked with a neoliberal policy invoking global competition as an objective imperative.

The 5th Environmental Action Programme (EAP) elaborated claims for technology which could provide efficiency gains and achieve environmental objectives:

> Many of the new clean and low-waste technologies not only reduce pollution substantially, but also economise on the consumption of raw materials to such extent that cost savings can more than offset initial higher investment costs and thereby reduce unit production costs. A case in point is represented in the development and use of new techniques in the field of genetic engineering and biotechnology; these offer considerable potential for useful applications in agriculture, food processing, chemicals, pharmaceuticals, environmental clean-up and the development of new material and energy sources (CEC 1993b: 28).

Thus SD was framed as resource efficiency in the image of agbiotech: greater economic efficiency would complement lower environmental pollution. Indeed, such claims pre-dated European cultivation of GM crops: they are 'guaranteeing yields, helping to cut the use of plant health products in combating pests and diseases, and creating quality products', according to the Economic and Social Committee, officially representing the Commission's link with civil society (CESE, 1998).

Such statements accepted claims from biotech companies that GM crops simultaneously achieve economic and environmental objectives by reducing input costs and waste. According to Monsanto, GM crops can solve societal problems by 'continuing the progress of high-yield agriculture'. Moreover, 'Our products create value for our customers by helping them to combine profitability with environmental stewardship.' For product impact, this means: more productive agriculture, more soil conservation, less insecticide use, less energy, better habitat protection (Monsanto 1997: 16). Likewise, GM crops facilitate 'the sustainable intensification of agriculture', according to Novartis (1998).

That agricultural model, linking eco-efficiency with economic competitiveness, informed EU policy in more general ways. According to the Commission's research strategy, public authorities must create and maintain 'an overall economic "environment" and a respect for free competition, which is necessary so that firms can effectively develop supply policies' – an imperative confirmed especially in the Maastricht treaty (CEC, 1992). This conflated the needs of society and industry, thus blurring public and private interests.

Biotech became a focus for making the public sector more dependent upon the private sectors. By 1990 EC funds for biotech research became dependent upon industry partners committing resources to a proposed project. Research was given a clear economic function, with 'more careful attention to the long-term needs of industry', according to managers of the DG-Research Biotechnology Division (Magnien and Nettancourt, 1993: 51). In their view, 'The most vital resource for the competitiveness of the biotechnology industry is the capacity to uncover the mechanisms of biological processes and figure out the blueprint of living matter' (ibid: 53) Nature was conceptualised as an information machine whose deficiencies had to be corrected, as an essential means towards European industrial regeneration and competitive advantage. This complemented the search for processes and innovations which could enhance productive efficiency of agriculture.

In the 1990s the Commission's Framework Programmes emphasised 'technologies needed to design and develop processes and produce "clean", high-quality products'. Towards those aims, it devoted enormous funds to GM techniques, in the name of 'pre-competitive' research whose results could later be developed into marketable products. Framework Programme 5 (1998-2002) included a large programme on 'Life Sciences and Biotechnology'; this echoed industry's discourse of synergies between pharmaceutical and agbiotech research, corresponding to industrial mergers in the mid-1990s. When these expectations were disappointed at the level of public suspicion and novel GM products, demergers sought to protect pharmaceutical firms from the negative image of agbiotech.

After GM products became largely blocked in Europe, industry reduced its own R&D investment there, and EC research priorities downplayed agri-food biotech. Framework Programme 6 (2002-07) emphasised research on 'biotech for health'. At the same time, funds were still allocated to agbiotech through various sub-programmes, e.g. 'Cell Factory', its name aptly expressing the industrialisation of nature for productive efficiency. Overall the EC R&D funds for agbiotech were sustained at approx. €100bn in FP6, nearly as much as in FP5, according to one estimate (FoEE, 2007: 10).

In appropriating the language of sustainable agriculture for productive intensification, companies have attributed agri-environmental problems to genetic deficiencies, while attributing benefits to inherent properties of GM crops, thus implying minimal grounds for regulatory scrutiny. Their strategy linked ecoefficiency language with the productivity imperatives of international competitiveness and thus a pro-globalisation political economy. This eventually informed the Commission's policy of 'risk-based regulation' in interpreting its legislation, as shown next.

4.2 Early regulatory conflict

In the late 1980s, when the Commission Services were formulating regulatory policy on agbiotech, debate centred on how to facilitate or shape the internal market in the run-up to the 1992 target. Within a dominant narrative, some officials regarded agbiotech as a benign technique for creating otherwise normal products; they cited 1986 OECD recommendations, which saw no scientific basis for statutory regulation of GMOs. By contrast, other officials advocated such legislation as necessary for avoiding or overcoming trade barriers; these could result from the restrictive legislation of Germany and Denmark, which had strong anti-biotech movements.

On the latter basis, DG XI for Environmental Protection gained broad support for its draft Directives regulating the contained use and deliberate release of all GMOs. Its proposal justified statutory regulation of all GMOs on a Community-wide basis, as a means to reconcile the internal market with high regulatory standards (EEC 1990). In that way, EM concepts provided important reference points for a policy counter-narrative, argues Gottweis. 'Environmental protection was represented as a positive sum-game and, hence, as an administrative problem', to be solved through statutory regulation along with citizens' participation (Gottweis 1998: 232-35).

According to the 1990 Directive, 'completion of the internal market would be based on a high level of protection for the environment and human health'. Member states had a duty to ensure that GMOs do not cause 'adverse effects' (EEC 1990). The Directive left open their definition – what would count as harm.

In this way, the legislation provided a potential means to shape the technological trajectory in environmentally more beneficial ways, but any such influence remained implicit and marginal in Commission policy. On the one hand, the Fifth EAP emphasised the problems of intensive agriculture and thus the need to develop more extensive methods (CEC 1993b: 35-36). On the other hand, biotechnological risks were framed in a naturalistic way, separated from agronomic issues: for example, GMOs offer environmental benefits, but 'there are concerns that this new technology might entail potential risks… GMOs could upset the delicate balance existing in nature or even have evolutionary impacts' (ibid: 60). These hypothetical scenarios helped to defend EC legislation against deregulatory attack but provided a weak basis to evaluate specific GM crops for agri-environmental effects.

Any regulatory shaping of agbiotech was further limited by political pressures, some hostile to the implicit precautionary basis of the Directive. Soon after enactment, it came under attack by a new consortium of chemical multinationals which were buying up seed companies; they attacked European 'over-regulation' as an obstacle to economic competitiveness. Moreover, this framing was accommodated in Commission documents, which advocated 'risk-based regulation' (CEC 1993a), especially 'the need for balanced and proportionate regulatory requirements commensurate with the identified risks' (CEC 1994). This language could mean

that any regulatory burdens must be justified by prior evidence of risk. Under such pressure to lighten regulatory burdens, the Environment DG XI sought industry allies as social partners who would help to elaborate and implement the Directive rather than undermine it (cited in Levidow et al. 1996: 142-43).

DG XI consulted environmental NGOs, which joined the EU-wide working group on risk assessment (ibid.). There they proposed broader criteria for evaluating GM products and opposed regulatory harmonisation as premature. Greenpeace soon withdrew from the working group, on grounds that all its arguments were ignored (FoEE 1996). Nevertheless these NGO efforts indirectly helped to limit deregulatory changes in legislation and practice.

Amid national differences over regulatory standards, these were levelled down through Commission decisions to approve GM crops for commercial cultivation in 1996-97. Safety claims accepted the normal hazards of intensive monoculture, whereby the 'pesticide treadmill' would be supplemented by a genetic treadmill. In particular, insecticidal or herbicide-resistant crops could generate resistant pests, but these scenarios were dismissed as merely agronomic problems which also sometimes occurred with conventional pesticide techniques. Some member states sought more evidence or control measures regarding such potential effects prior to regulatory approval, but they were marginalised in the EU-wide procedure (Levidow et al. 1996, 2000).

4.3 Challenges to agri-industrial efficiency

When the Commission approved an insecticidal maize in January 1997, despite opposition from member states, critics drew analogies to the 'mad cow' scandal. This had undermined the credibility of official safety claims for food products, while aggravating suspicion towards intensive agricultural methods. Journalists highlighted attacks upon the Commission for 'recidivism', i.e. for repeating its crimes over approval of British beef. Extending such analogies, activists cited unpredictable effects of agbiotech as grounds for a moratorium on GM products.

Opponents framed agbiotech as diverse threats: GM crops would impose 'uncontrollable risks', would spread 'genetic pollution', would extend 'unsustainable' intensive agricultural methods which had already generated agri-food hazards, and would extend corporate power over the agri-food chain (cited in Levidow 2000). Activists eventually generated a broad societal opposition: according to opinion surveys, the public distrusted the role of the biotechnology industry in developing new products (Gaskell et al 2001: 71).

Thus critics challenged the biotechnological vision of more efficient inputs remedying agricultural problems. They also counterposed different agriculture models − organic farming and alternative cultivation methods such as Integrated Pest Management. Protest was driven mainly by activists from environmentalist and farmer groups. In some countries, e.g. France and Italy, mass organisations of small-scale farmers played political roles in generating mass opposition to GM crops. In response to public controversy, some governments devised a more cautious regulatory approach to GM crops, often with greater opportunity for public comment and consultation. Four national examples briefly illustrate those pressures and responses.

In the late 1990s the French agbiotech debate expanded from 'risk' to sustainability issues, now framing agriculture as a common good linking producers with consumers. Some industrial-type farmers had sought access to GM crops as a means to enhance their economic competitiveness. By contrast, the Confédération Paysanne attacked such products as a multiple threat – to their economic independence, to high-quality French products, to consumer choice and even to democracy. They counterposed their own *paysan savoir-faire*, as a basis for a different societal future (Heller 2002). They advocated de-intensification measures, based on 'remunerative agricultural prices and sustainable family farming, with multiple benefits for society' (CPE 2001). Supporting agbiotech in principle, the French government initially led EU-wide approval of a GM herbicide-tolerant oilseed rape, but soon reversed its stance and blocked approval. This regulatory blockage responded mainly to expert concerns about a genetic treadmill, while also accommodating some public anxieties.

Italian anti-agbiotech opponents sought to protect the agro-food chain as an environment for craft methods and local specialty products, known as *prodotti tipici*. The Italian Parliament had already allocated subsidies to promote such products and foresaw these being displaced by GM crops. According to a Parliamentary report, the government must 'prevent Italian agriculture from becoming dependent on multinational companies due to the introduction of genetically manipulated seeds'. Moreover, when local administrations apply EU legislation on sustainable agriculture, they should link these criteria with a requirement to use only non-GM materials. Parliament was adopting arguments from Coltivatori Diretti, a million-strong union of mainly small-scale farmers who opposed GM crops (Terragni and Recchia 1999). Implicitly responding to these pressures, Italian authorities obstructed regulatory approval of GM crops.

The Austrian government was already promoting organic agriculture in the early 1990s, and agbiotech opponents turned GM crops into a symbolic threat to that alternative economic strategy. Austrian regulators unfavourably compared potential environmental effects of GM crops to methods which use no agrochemicals, among others grounds to oppose commercial approval (Torgersen and Seifert 2000). Civil servants drew links between the Precautionary Principle and sustainable development. In their risk-benefit analysis of GM crops, risks were always uncertain, while benefit was understood as promoting the political aim of a society oriented towards sustainability, understood mainly as organic farming (Torgersen and Bogner 2005).

In the UK agbiotech critics drew an analogy between GM crops, industrialized agriculture and the market pressures which led to the BSE crisis. These suspicions were echoed widely in civil society and even in government agencies. The Consumers Association attacked the agro-food industry for its 'unshakeable belief in whizz-bang techniques to conjure up the impossible – food that is safe and nutritious but also cheap enough to beat the global competition' (McKechnie 1999). As official advisors to the government, nature conservationists warned that broad-spectrum herbicides could increase harm to wildlife habitats in or near agricultural fields. According to a report of the UK Environment Agency, agbiotech products became controversial because they are designed for an 'increasingly intensive monoculture'. Therefore GM crops should be evaluated in a wider debate about sustainable agriculture, 'not just relative to today's substantially less-than-sustainable norm', argued their report (Everard and Ray 1999).

In various ways across European countries, agbiotech was turned into a symbol of neoliberal globalisation, agri-industrial threats and a misguided efficiency. Playing on consumer fears about GM food safety, radical environmentalists stimulated an anti-agbiotech coalition linked several themes: food sovereignty, local control of food production, idealised notions of rural farming, ‘natural’ food, etc. NGOs warned that small-scale, poor farmers will be disadvantaged by large intensive farms, often based on agbiotech products (Greenpeace 2006). Those issue-framings relate to rival political economies: radical greens promoted a decentralist political economy, in opposition to a globalised agri-industrial production (Hines 2000; Woodin and Lucas 2004).

By the late 1990s agbiotech products were being blocked through a commercial boycott, more than by any regulatory obstacles. Protests demanded comprehensive GM labelling, so that consumers would not be ‘force-fed’ GM food. Through a series of voluntary decisions and statutory rules, more stringent criteria were adopted for GM product labelling. Soon European food retail chains excluded GM grain from their own-brand products, rather than apply a ‘GM’ label. Consequently, GM grain found a market only for animal feed, whose products required no GM label (Levidow and Bijman, 2002). European farmers were deterred from cultivating GM crops, except in some maize fields in Spain, which otherwise would have a shortage of animal feed.

4.4 EU-level consultation as a platform for dissensus

Since at least the early 1990s the Commission has funded public-opinion surveys and organised dialogue with stakeholders. This activity took the form of ‘public information’ and

consumer dialogue workshops (Galloux et al 1998: 182). The EU level had little deliberative discussion about technology choices, though such deliberation took place in participatory Technology Assessment in some member states. To some extent, these national TA procedures enhanced democratic accountability for regulatory policy, but they channelled the socio-cultural conflict over innovation choices rather than addressing its basis (Levidow, 2007). In such deliberative-participatory procedures, at issue were the forms and meanings of agri-industrial eco-efficiency, not simply its enhancement.

After public protest erupted against agbiotech in the late 1990s, conflict over agri-innovation trajectories became more explicit. When the Commission sponsored EU-level stakeholder consultations, participants disagreed about how to define the policy problem, especially the criteria for agricultural research priorities as well as for risk assessment. Agbiotech opponents found extra platforms for societal dissensus.

At a 'Stakeholder Dialogue on Environmental Risks and Safety of GM Plants', partly funded by the Commission, sustainable development became a contentious reference point. According to some industry and government representatives, agbiotech products could facilitate Integrated Crop Management systems, but NGOs regarded them as incompatible. They sought a greater knowledge-base for adequate regulation and for a different innovation trajectory:

> … generation of data on the impacts of different agricultural systems would provide a context for evaluation of the impacts of GM crops, and would make it easier to judge their significance.
> What are the relevant agricultural systems to compare? … Options are organic, extensive/integrated, or intensive/conventional agriculture… (SBC 2001: 6, summary of Working Group III)

At a similar workshop, nominally on 'Public Information and Public Participation' in agbiotech regulatory procedures, discussion soon moved on to agri-innovation priorities. NGOs demanded research on less-intensive crop-protection methods, both as a more stringent comparator and as an alternative societal choice. 'Public participation might lead to better identification of research needs, e.g. comparison of agro-ecological consequences of conventional agriculture, IPM with/without GM crops, and organic agriculture' (SBC 2002: 9). At least implicitly, these disagreements expressed rival political economies for future European agriculture.

In 2001 the Commission initiated a formal consultation on biotechnology strategy. Somewhat opening up the issue, its consultation paper noted a change away from efficiency and productivity towards quality and diversity in agri-food production, especially towards sustainable, environmental friendly agriculture. Citizens were invited to discuss the question, 'How may the twin objectives of competitiveness of EU agriculture and the trend towards sustainable practices be reconciled?' Yet the consultation paper presumed that both objectives depend upon biotechnological innovation: GM crops offer products for 'sustainable agricultural practices with reduced environmental impact' (CEC 2001: 7). In written submissions and comments at public events, NGOs put forward alternative agri-futures, but these remained marginal to Commission policy, equating sustainable agriculture with eco-efficient agbiotech.

In its definitive strategy document, the Commission extended earlier arguments about biotechnological imperatives. Given the 'revolution taking place in the knowledge base of life sciences and biotechnology', this could provide a major contribution to the EC 'becoming a leading knowledge-based economy'. At the same time, the Commission emphasised the scope to shape innovation for greater societal benefit:

> Europe is faced with a major policy choice: either accept a passive and re-active role, and bear the implications of the development of these technologies elsewhere, or develop pro-active policies to exploit them in a responsible manner, consistent with European values and standards. The longer Europe hesitates, the less realistic this second option would be (CEC 2002: 7).

The strategy document celebrated the prospects for GM crops to generate 'more sustainable agricultural practices', equated with eco-efficiency measures such as pesticide reduction (CEC 2002: 6, 15). Technological progress carries socio-ethical implications, which 'cannot be adequately addressed within the narrow context of regulatory product approvals'; consequently, EU procedures need transparency, accountability and participatory approaches. Nevertheless, regulatory oversight 'is the expression of societal choices': rules should ensure that market mechanisms function effectively, so that safe products are available to accommodate consumer preferences (ibid: 14, 21).

5 Regulatory changes versus agri-efficiency

In response to public controversy, some governments devised a more cautious regulatory approach to GM crops; agri-environmental criteria shifted in ways less amenable to the agri-efficiency for which GM crops were designed. Some even banned GM products which already had EU approval. In 1999 the UK announced a voluntary moratorium on commercial cultivation of GM crops, given the uncertainties about how herbicide sprays on herbicide-tolerant crops could affect farmland biodiversity. This delay aimed to allow time for commercial-scale testing of herbicide usage and its effects, thus broadening 'the environment' to be protected (Toke 2004).

Moreover, in 1999 the EU Council blocked consideration of any more GM products; several members demanded that the EU regulatory procedure must first incorporate more stringent, precautionary criteria. This procedural blockage, which became known as the EU Council's de facto moratorium, expressed a policy impasse over regulatory criteria, as well as difficulties in addressing public concerns.

The EU Council moratorium stimulated changes towards broader regulatory criteria for agbiotech. In consultation with member states, the Commission revised the 1990 Directive. The revision encompassed a broader range of risks, e.g. the effects of herbicide usage on GM crops, and required that scientific uncertainty be made explicit about any 'identified risk'. The Directive now also required public consultation (EC, 2001). Together these changes provided greater public accountability for regulatory decisions, with criteria potentially favouring environmental improvement, though these remained entirely within 'risk' judgements on each GM product.

In parallel with those changes in EU law, the Commission sought to restart the EU-wide regulatory procedure, which had been stalled since 1999. In its view, precaution could not justify blockages or bans on the GM products under consideration. When the regulatory procedure finally resumed in 2003, member states applied more stringent criteria than in the late 1990s, leading to more disagreements over new GM products. More member states than before challenged the available evidence of safety and raised extra uncertainties; some challenges came from governments which anyway opposed GM crops (e.g. Italy, Greece, Austria). Environmental NGOs continued to attack safety claims, while counterposing alternative agricultures. Whenever the Commission sought EU approval for a specific GM product, there was little support from member states, so the Commission lacked legitimacy when approving the product (Levidow et al. 2005).

Also in response to the EU Council demands, with strong support from the Parliament, the Commission broadened the criteria for 'GM' labelling. Formerly this requirement depended upon the presence of detectable DNA or protein in GM food. Under a new law, 'GM' labelling was now required for any food or feed product containing GM material, regardless of detectability; and its presence must be traceable throughout the agro-food chain (EC 2003a, 2003b). This effectively required labelling for a broader range of products than before. With this extra weapon, NGOs made further efforts to deter food companies from using GM grain, whose use was mainly limited to animal feed.

The inadvertent spread of GM material became yet another contentious issue. European agbiotech opponents had warned against the prospect that GM crops would irreversibly 'contaminate' the environment and non-GM crops. This could mean that they require a GM label, yet preventive containment measures could constrain GM crop cultivation.

To regain control over the 'contamination' issue, the Commission developed a 'co-existence' policy for ensuring farmers' free choice to cultivate GM, conventional or organic crops. This policy sharply distinguished between environmental issues, appropriate for risk regulation under the Directive, versus merely economic damage from the spread of 'safe' GM material to non-GM crops (CEC 2003a). But this key distinction was challenged, blurred and undermined, even by a legislative change. Again under pressure from the Parliament, the Commission agreed to amend the Deliberate Release Directive so that 'Member states may take appropriate measures to avoid the unintended presence of GMOs in other products' (EC 2003a: 20).

For some member states and regions, moreover, 'coexistence' policy increasingly meant segregation measures which would marginalise or preclude GM crops. In a Europe-wide charter of regional authorities, they discursively linked 'GMO-free zones' with food sovereignty, 'quality' labels on food products and regional biodiversity. The charter identified GM crops as a threat to 'sustainable and organic farming and regional marketing priorities for their rural development' (FFA 2005).

This conflict expressed rival political economies: GM crops extending an agri-industrial paradigm, versus alternatives elaborating an agrarian-based rural development paradigm (Levidow and Boschert, 2008; Marsden, 2008). When the agbiotech opposition was joined by the Assembly of European Regions, it proposed that coexistence would be based on in-depth feasibility studies examining the environmental, socio-economic and cultural impact of GMOs. Areas could be designated as 'GMO free' in order to protect any added value of certified quality products (AER/FoEE 2005). This proposal generalised from stringent rules already being devised by some regional authorities.

6 Conclusion: EM evaluated as theory

The introduction established three main aims, which can be elaborated as questions.

- About the case:

On what basis has the European Commission promoted agbiotech?
Why did the Commission's agbiotech policy become so difficult to implement?
How did regulatory changes arise and affect the outcome?

- About the theory through the case:

How can EM perspectives illuminate EU-level conflicts around the Commission policy?
What are the explanatory strengths and limitations of EM as theory in this case?
What other perspectives could address those limitations?
How do normative standpoints of a theory enhance or limit its explanatory utility?

6.1 Explanatory limitations

Some EM perspectives can help to explain the early story of EU agbiotech policy, e.g. how 'eco-efficiency' improvements framed agbiotech innovations and gained government support, especially from the European Commission. According to an early EM perspective emphasising resource-efficiency and government measures to avoid market failure, 'the dirty and ugly industrial caterpillar will transform into an ecological butterfly' (Huber, 1985: 20). Consistent with this perspective, agbiotech was portrayed as a benign eco-efficient tool, essential for both environmental improvement and global economic competitiveness. To facilitate market success, agbiotech was promoted as both an instrument and beneficiary of neoliberal policies – by extending patent rights, by making the public sector more dependent upon private finance, by promoting further industrialisation of agriculture, etc. Those imperatives officially justified a policy of 'risk-based regulation', aiming to facilitate approval and commercialisation of GM products.

By the mid-1990s, EU-wide disputes ensued over the appropriate regulatory standards. The dominant policy adopted industry claims for eco-efficient, safe GM products, while accepting the normal hazards of intensive monoculture. Some policymakers sought to test these claims through more stringent criteria, which could shape innovation along lines more amenable to environmental improvement. Commission policy featured tensions and shifts between these two different ways to construct an EU internal market, as in environment policy more generally (cf. Weale and Williams 1993). As this tension also illustrates, regulation can establish an imperative for environmental improvement, while enhancing the capacity to accommodate it (Murphy and Gouldson, 2000: 42). In the EU agbiotech case, such state pressure was contingent upon political struggles and their outcomes.

The early EU agbiotech story has some features in common with other case studies of ecological modernisation. All stakeholders shared a common aim to reduce chemical pollution, and government promoted an industrial solution in the name of eco-efficiency. In the acid rain case, for example, the policy problem was officially diagnosed as inefficient production methods, and the pollution problem had a consensual definition. NGOs' apocalyptic language about acid rain was appropriated by government to justify modest technological changes. The techno-fix achieved a problem-closure in the narrow sense that environmental NGOs' disappointment did not turn into opposition (Hajer, 1996: 195, 252).

In the agbiotech case, however, the NGOs' apocalyptic language was directed against the supposed biotechnological solution for agro-environmental problems. Through mass protest since the late 1990s, the would-be 'ecological butterfly' was popularly stigmatised as a threat to the environment, sustainable development and democracy. Contrary to the biotechnological eco-efficiency framework, critics diagnosed agri-industrial efficiency as a fundamental problem, while counterposing alternative models of desirable agriculture.

Societal conflict was translated into regulatory disputes over the appropriate safety standards for GM products. This tension arose from an EU policy seeking innovation which combines greater economic efficiency with less pollution, while representing this policy as 'sustainable development' (cf. Hanf, 1996; Baker, 2007). As a result, all those concepts readily became contentious, acquiring divergent meanings.

Since the late 1990s agbiotech products have faced more stringent, precautionary criteria for risk assessment, labelling and segregation. This shift intensified EU-wide regulatory conflict, without enhancing governmental support for GM products. Demands for more stringent regulation provided an extra means to block commercialisation, not simply to stimulate and select GM products for environmental improvement. GM labelling criteria provided greater opportunity for agbiotech opponents to deter the commercial use of GM products; by 1999 food retail chains were boycotting GM grain, which since then has found a market only in animal feed.

Those societal conflicts and their outcomes cannot be readily explained by EM perspectives which emphasise cooperative state-industry relations, as noted by Mol (1996). The main obstacle to progress is understood as market failure, in turn due to inadequate state assistance and incentives for innovators. Such perspectives take for granted the capitalist capacity for environmental improvement, attribute environmental degradation to market failure, understand 'eco-efficiency' as an input-output efficiency of resource usage, understand pollution in narrowly biophysical terms, and model civil society as supporters of such efficiency improvements.

6.2 Wider perspectives

In order to explain the difficulties of the European Commission over agbiotech, let us look again at four wider perspectives: state failure, cultural-discursive frames, rival political economies and reflexive policymaking. All have been linked with EM by the authors surveyed earlier, though the four perspectives were generally isolated from each other. Here they are brought together in complementary ways for explaining the case at hand.

The European societal conflict arose from state failure to consider alternative innovation trajectories, as generally diagnosed by Jänicke (1990) – not simply from market failure to provide adequate incentives for eco-efficiency innovations. To undermine agbiotech, critics used a societal and environmental crisis (ibid.); indeed, they actively created such crisis. Cultural-discursive perspectives can illuminate why and how they did so.

For some EM theorists, technological eco-efficiency has been understood less as an institutional reality than as a discursive-framing strategy to promote specific technologies and societal futures (e.g. Weale and Williams, 1993). In some cases, new technologies have prevailed despite doubts about their claims for environmental superiority, and despite environmentalist aspirations for fundamental societal changes in resource usage (Hajer, 1995). 'Many citizens understood environmental problem in different, more culturally loaded terms.' Furthermore, governments linked eco-modernist agendas with neo-liberal economic agendas, thus providing a vulnerable target for critics (Hajer and Versteeg, 2005: 179). This cultural-discourse account of EM helps to explain underlying conflicts which were managed in the acid rain case but not in the agbiotech case, where opponents undermined claims for GM crops as sustainable agriculture.

Cultural discourses were strategically linked with rival models of political economy, as also seen in the EU agbiotech case. Agbiotech promoters linked GM crops with agri-industrial development and globalisation imperatives, while opponents linked alternatives with agrarian-based rural development with 'green' local production (cf. Marsden and Sonnino, 2005). Through 'GM-free zones', regional authorities have been elaborating alternative agri-innovations which would favour less-intensive cultivation methods, local producer-consumer links, quality products, etc. (Levidow and Boschert, 2008).

Deliberative-reflexive procedures provided means for potentially mediating the societal conflict – but also greater opportunity for agbiotech critics to challenge the agbiotech innovation trajectory as unsustainable, especially by comparison with alternatives. This case illustrates contradictory roles for deliberative-reflexive procedures, as Martin Hajer has noted: 'reflexive institutional arrangements' can better address societal conflicts over innovation choices, yet stakeholder consultation can also provide more platforms for societal dissensus (Hajer, 1995: 269). According to some EM theories, eco-efficiency policy frameworks anyway institutionalise ecology, reflexivity and doubt (Mol, 1996: 318-19). If so, then reflexive policymaking is not a distinctive type or choice, though it can take various forms. For agbiotech policy at the EU level, regulatory procedures were opened up for deliberating more stringent regulatory norms, as an arena for channelling societal antagonisms over the innovation trajectory.

6.3 Normative standpoints and implications

In sum, normative standpoints inform the four perspectives above – state failure, cultural-discursive frames, rival political economies and reflexive policymaking. Implicitly or explicitly, the cited authors normatively favour particular forms of socio-political power, civil society involvement, resource usage and environmental values. Those normative standpoints enhance the analytical utility of EM for explaining EU societal conflict over innovation trajectories. By contrast, when other EM perspectives normatively attribute environmental degradation to resource-inefficiency or market failure, then at most such perspectives can explain successful, socially accepted innovations.

Those normative differences cast a new light upon proposals that EM should be supplemented with other analytical perspectives on relations between the state, society and industry (Buttel, 2000: 64). Normative standpoints inform analytical perspectives and bear upon their explanatory utility. Such norms are integral to the perspectives, not just complementary (notwithstanding Mol, 1999: 171). More profoundly, norms bear upon what *counts as* explanatory utility, dependent upon accounts of imaginable and desirable futures.

References

AER/FoEE (2005) Safeguarding Sustainable European Agriculture: Coexistence, GMO free zones and the promotion of quality food produce in Europe, 17 May conference, www.a-e-r.org

Baker, S. (2007) 'Sustainable development as symbolic commitment: declaratory politics and the seductive appeal of ecological modernisation in the European Union', *Environmental Politics* 16(2): 297-317.

Barry, J. and Patterson, M. (2004) Globalisation, ecological modernisation and New Labour, *Political Studies* 52(4): 767-784.

Buttel, F. (2000) Ecological modernization as social theory, *Geoforum* 31: 57-65.

Buttel, F. (2005) The environmental and post-environmental politics of genetically modified crops and foods, *Environmental Politics* 14(3): 309-323.

CEC (1983) Third Environmental Action Programme, *Official Journal of the European Communities*, C 46, 17 February.

CEC (1987) Fourth Environmental Action Programme, *Official Journal of the European Communities*, C 329, 7 December.

CEC (1992) 'Research after Maastricht: an assessment, a strategy', *Bulletin of the European Communities*, supplement 2/92. Brussels: Commission of the European Communities.

CEC (1993a) Growth, Competitiveness, Employment: The Challenges and Ways Forward into the 21st Century, *Bulletin of the European Communities,* supplement 6/93, esp. pp.100-103. Brussels: Commission of the European Communities.

CEC (1993b) *Towards Sustainable Development,* Fifth Environmental Action Programme; also in *Official Journal of the European Communities*, C 138, 17 May: 5-98.

CEC (1994) Biotechnology and the White Paper on Growth, Competitiveness and Employment: preparing the next stage, *Ebis Newsletter* 4(2): 2-5. Brussels: European Biotechnology Info Service.

CEC (2001) Sixth Environmental Action Programme. A Sustainable Europe for a Better World: A European Union Strategy for Sustainable Development. COM (2001) 264.

CEC (2002) *Life Sciences and Biotechnology: A Strategy for Europe*, http://europa.eu.int/comm/biotechnology

CEC (2003) Life Sciences and Biotechnology: A Strategy for Europe: Progress Report and Future Orientations, 5 March.

CEC (2003) Commission Recommendation of 23 July on guidelines for the development of national strategies and best practices to ensure co-existence of GM crops with conventional and organic farming.

CESE (1998) Opinion of the Economic and Social Committee on Genetically modified organisms in agriculture — impact on the CAP, *Official Journal of the European Communities*, C 284: 39-50.

Christoff, P. (1996) Ecological modernisation, ecological modernities, *Environmental Politics* 5 (3): 476-500.

CPE (2001) To change the CAP, Brussels: Coordination Paysanne Européenne, www.cpefarmers.org

Dobson, A., (1990) *Green Political Thought*, London: Harper Collins

EC (2003a) Regulation 1829/2003 of 22 September 2003 on genetically modified food and feed, *O.J.* L268, 18 October: 1-23.

EC (2003b) Regulation 1830/2003 of 22 September 2003 concerning the traceability and labelling of GMOs and traceability of food and feed produced from GMOs and amending Directive 2001/18, *O.J.* L268, 18 October: 24-28.

EEC (1990) Council Directive 90/220/EEC on the deliberate release to the environment of genetically modified organisms, *Official Journal of the European Communities*, L 117: 15-27.

EEC (2001) European Parliament and Council Directive 2001/18/EC of 12 March on the deliberate release into the environment of genetically modified organisms and repealing Council Directive 90/220/EEC, *O.J.* L 106: 1-38.

ENDS (2001) Commission sets out strategy for sustainability policy, *ENDS Report* 316: 47.

Everard, M. and Ray, D. (1999) *Genetic Modification and Sustainability*. 2020 Vision Series No.1. Bristol: Environment Agency/Cheltenham: The Natural Step.

FoEE (1996) Working Group on risk assessment meets again, *Biotech Mailout* 4: 4-5. Brussels: Friends of the Earth Europe.

FoEE (2007) *The EU's Biotechnology Strategy: mid-term review or mid-life crisis?* Brussels: Friends of the Earth Europe.
FFA (2005) Foundation for Future Farming, Assembly of European Regions, Berlin Manifesto for GMO-free Regions and Biodiversity in Europe, January, www.are-regions-europe.org
Galloux, J, Gaumont Prat , H, Stevers E (1998) Europe, in Bauer, J. and Gaskell, G. (eds), *Biotechnology in the Public Sphere*, London: Science Museum, pp.177-185
Gaskell, G and Bauer, M (eds) (2001) *Biotechnology 1996-2000*, London: Science Museum
Gottweis, H. (1998) *Governing Molecules: The Discursive Politics of Genetic Engineering in Europe and the United States*. Cambridge, MA: MIT Press.
Gottweis, H. (2005) Transnationalizing recombinant-DNA regulation: between Asilomar, EMBO, the OECD, and the European Community, *Science as Culture* 14 (4): 299-308.
Greenpeace (2006) *The Future of Agriculture*, http://www.greenpeace.org.uk, accessed 02/06/2006
Hajer, M. (1995) *The Politics of Environmental Discourse,* Oxford: Oxford University Press
Hajer, M. and Versteeg, W. (2005) 'A decade of discourse analysis of environmental politics: achievements, challenges, perspectives', *Jnl of Envtl Policy & Planning* 7(3): 175-84.
Hanf, K. (1996) Implementing environmental policies, in A. Blowers & P. Glasbergen (eds), *Environmental Policy in an International Context − Prospects for Environmental Change*. London: Arnold, pp.197-221.
Heller, C. (2002) From scientific risk to paysan *savoir-faire*: peasant expertise in the French and global debate over GM crops, *Science as Culture* 11(1): 5-37.
Hines, C. (2000) *Localization: A Global Manifesto*, London: Earthscan
Huber, J. (2000) Towards industrial ecology: sustainable development as a concept of ecological modernization, *Journal of Environmental Policy and Planning*, 2(4): 269-85.
Huber, J. (1985) *Die Regenbogengesellschaft. Ökologie und Sozialpolitik*, Frankfurt am Main: Fisher Verlag.
Jänicke, M. (1990) *State Failure: The Impotence of Politics in Industrial Society*. University Park: Pennsylvania State University Press [translation of *Staatsversagen*, 1986].
Jepson, W., Brannstrom, C., Stancato de Souza, R., (2005) A case of contested ecological modernisation: the governance of genetically modified crops in Brazil, *Environment and Planning C: Government and Policy* 23(2): 295-310.
Langhelle, O. (2000) Why ecological modernization and sustainable development should not be conflated, *Journal of Environmental Policy and Planning*, 2(4): 303-22.
Levidow, L. (2000) Pollution metaphors in the UK biotechnology controversy, *Science as Culture* 9 (3): 325-51.
Levidow, L. (2007) 'European public participation as risk governance: enhancing democratic accountability for agbiotech policy?', *East Asian Science, Technology and Society: an International Journal* 1(1): 19-51, special issue on Public Participation in Science and Technology, http://www.springerlink.com/content/7wv9764lw42r7867/fulltext.pdf
Levidow, L. and Bijman, J. (2002) Farm inputs under pressure from the European food industry, *Food Policy* 27 (1): 31-45.
Levidow, L. and Boschert, K. (2008) 'Coexistence or contradiction? GM crops versus alternative agricultures in Europe', *Geoforum* 39(1): 174-90.
Levidow, L., Carr, S., von Schomberg, R., Wield, D. (1996) Regulating agricultural biotechnology in Europe: harmonization difficulties, opportunities, dilemmas, *Science & Public Policy* 23 (3): 135-57.
Levidow, L., Carr, S., Wield, D. (2000) Genetically modified crops in the European Union: regulatory conflicts as precautionary opportunities, *Journal of Risk Research* 23 (3): 189-208.
Levidow, L., Carr, S., Wield, D. (2005) EU regulation of agri-biotechnology: precautionary links between science, expertise and policy, *Science & Public Policy* 32 (4): 261-76.
Magnien, E. and de Nettancourt, D. (1993) 'What drives European biotechnological research?', in E.J.Blakelely and K.W.Willoughby (eds) *Biotechnology Review no.1: The Management and Economic Potential of Biotechnology*, pp.47-48. Brussels: Commission of the European Communities.
McKechnie, S. (1999) Food fright, *The Guardian*, 10 February (director of the Consumers Association).
Marsden, T.K. (2004) The quest for ecological modernisation: respacing rural development and agro-food studies, *Sociologia Ruralis* 44 (2): 129–147.

Marsden, T.K (2008) Agri-food contestations in rural space: GM in its regulatory context, *Geoforum* 39(1).
Marsden, T.K. and Sonnino, R. (2005) Rural food and agri-food governance in Europe: tracing the development of alternatives, in Higgins, V., Lawrence, G. (eds), *Agricultural Governance: Globalization and the New Politics of Regulation*, London: Routledge, pp.50-68.
Milanez, B. and Bührs, T. (2007) Marrying strands of ecological modernisation: a proposed framework, *Environmental Politics* 16(4): 565-83.
Mol., A.P.J (1995) *The Refinement of Production: Ecological Modernisation Theory and the Chemical Industry*. Utrecht: Jan van Arkel/International Books.
Mol., A.P.J (1996) Ecological modernisation and institutional reflexivity: environmental reform in the late modern age, *Environmental Politics* 5 (2): 302-323
Mol., A.P.J (1999) Ecological modernization and the environmental transition of Europe: between national variations and common denominators, *Journal of Environmental Policy & Planning* 1(1): 167–181.
Mol., A.P.J. (2000) The environmental movement in the era of ecological modernisation, *Geoforum* 31(1): 45-56.
Murphy, J. and Gouldson, A. (2000) 'Environmental policy and industrial innovation: integrating environment and economy through ecological modernisation', *Geoforum* 31(1): 33-44.
Monsanto (1997) *Report on Sustainable Development*. St Louis, MO: Monsanto Company.
Novartis (1998) *Novartis Bt-11 Maize*. Basel: Novartis
SBC (2001) Stakeholder Dialogue on Environmental Risks and Safety of GM Plants, Leiden, February 28 – 1 March, workshop report by Schenkelaars Biotechnology Consultancy on behalf of the EFB Task Group on Public Perceptions of Biotechnology, www.sbcbiotech.nl
SBC (2002) Report of a European Workshop: Public Information and Public Participation in the Context of EU Directives 90/220 and 2001/18. Leiden, 30-31 May. Schenkelaars Biotechnology Consultancy, www.sbcbiotech.nl
Terragni, F. and Recchia, E. (1999) Italy: Precaution for Environmental Diversity?, report for Safety Regulation of Transgenic Crops: Completing the Internal Market, DGXII RTD project coordinated by the Open University, http://technology.open.ac.uk/cts/srtc/index.html
Seipell, O. (2000) Ecological modernization as a theoretical device: strengths and weaknesses, *Journal of Environmental Policy and Planning*, 2(4): 287-302.
Toke, D. (2002) Ecological modernisation and GM food, *Environmental Politics* 11 (3): 145-163.
Toke, D. (2004) *The Politics of GM Food*. London: Routledge.
Torgersen, H. and Seifert, F. (2000) Austria: precautionary blockage of agricultural biotechnology, *Journal of Risk Research* 3 (3): 209-217.
Torgersen, H. and Bogner, A. (2005) Austria's agri-biotechnology regulation: political consensus despite divergent concepts of precaution, *Science & Public Policy* 32 (4): 277-84.
Weale, A. (1992) *The New Politics of Pollution*. Manchester Univ Press
Weale, A. (1993) Ecological modernisation and the integration of European environmental policy, in *European Integration and Environmental Policy*. London: Belhaven, pp.202-16.
Weale, A. and Williams, A. (1993) Between economy and ecology? The single market and the integration of environmental policy, in D.Judge, ed., *A Green Dimension for the European Community*. London: Frank Cass, pp.45-64.
Woodin, M. and Lucas, C. (2004) *Green Alternatives to Globalisation - A Manifesto*, London: Pluto.