8. Ecological modernization: industrial transformations and environmental reform

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INTRODUCTION: THE HISTORICAL BACKGROUND OF ECOLOGICAL MODERNIZATION

The history of environmental concern in western, industrial societies is usually divided into two or three different waves in the literature, depending on the authors' historical outlook. At the outset of the twentieth century, the first wave of environmental concern focused mainly on the degradation of 'natural' landscapes due to increasing industrialization and the expansion of cities. Social concern during this phase of environmental degradation did not so much question the foundations of the emerging industrial society; the emphasis was rather on demands for the protection of valuable nature areas against the devastating influence of rapid industrialization and urbanization. Nature reserves and semi-protected areas are the typical products of this wave in most industrial societies.

The central notion of environmentalism in the 1970s was that a fundamental reorganization of the social order was a conditio sine qua non for an ecologically sound society. But the ecology-inspired demand for social change during this second wave resounded only to a limited extent in the institutions of industrial society. Among its most significant successes were the creation of government departments for the environment in most industrial societies, an expanding environmental legislation and planning and a rapid increase in the number and membership of non-governmental environmental organizations. Although a large number of measures to combat environmental destruction were adopted and some were actually implemented, most of the challenged institutions of modernity, such as those which play a key role in the industrial structure, in economic relations and in scientific–technological developments, were not deterred from their devotion to a narrowly defined economic 'progress'. The meagre results of industrial change in the 1970s and 1980s are reflected in the dominant social theories on environmental degradation and (failing) environmental reform. It was especially neo-Marxists and so-called deindustrialization theories that concentrated on the explanation of a continuing environmental crisis and stagnating environmental reform. Where neo-Marxists such as Hans Magnus Enzensberger (1974), Allan Schnaiberg (1980) and David Pepper (1984) emphasized the central role of the capitalist mode of production in both the generation of environmental degradation and the impossibilities of overcoming this environmental devastation, deindustrialists or counterproductivity theorists such as the earlier Rudolf Bahro, Otto Ullrich, the late André Gorz and Barry Commoner concentrated primarily on the devastating influence of large technological–industrial developments (often, but not always, in relation to capitalist modes of production). In that sense the general debate in the 1960s about whether industrialism or capitalism should be seen as the central characteristic of western societies was prolonged into the 1970s in the environmental domain.

A third upsurge of attention to the 'burdening of the sustenance base' in the industrial societies becomes noticeable from the late 1980s onward. The Brundtland report (WCED, 1987) and the United Nations Conference on Environment and Development (1992) are often cited as the milestones of this third wave. In comparing the environmental upsurge in the 1970s with the third rise in environmental awareness in the late 1980s and early 1990s, some important distinctions have been observed by various authors (for example, Buttel and Taylor, 1992). As reported, the nature of, and the key notions employed in, the current environmental debate differ considerably from those in its predecessor. But the third environmental wave differs from its predecessors not only with respect to the nature of the environmental debate and in the key notions on which it centres. The last decade of this millennium is experiencing the commencement of actual, environment-induced, transformations of the institutional order of industrial society. Today's institutional transformations to protect the environment can no longer be interpreted as mere window-dressing, as environmental reform was generally seen by environmental commentators in the 1970s. It is precisely against this background that the theory of ecological modernization has gained so much attention and popularity. Although its history dates back to the early 1980s, the idea of ecological modernization emerged especially in the early 1990s in the writings of scholars in political science and sociology. Ecological modernization does not focus so much on the continuing burdening of the sustenance base but rather concentrates on the environment-induced restructuring of processes of production and consumption.

There exists an additional difference between the third and the second wave, with respect to our sociological understanding. During and after the second wave general sociological theory was hardly informed by environmental questions and its 'refinement' for a sociological understanding of environmental degradation and reform was limited. The 1990s, however, show an increasing commitment of general sociological theory to ecological problems (for example, the later work of Anthony Giddens) and some major theories were even essentially built around (global) environmental questions, such as Ulrich Beck's Risk Society theory (see also Goldblatt, 1996). Ecological modernization theory and other 'third wave' social theories on the environment profit from this increasing attention paid by social theory to environmental questions.

ECOLOGICAL MODERNIZATION AS A THEORY OF SOCIAL CHANGE

Albert Weale (1992: 75) rightly observes: 'There is no one canonical statement of the ideology of ecological modernisation as The General Theory is a source for Keynesianism. It is a view about the relationships between environment, the economy, society and public policy that has to be pieced together from various sources.'

Different authors – social scientists, environmental activists, political parties and managers – have used the notion of ecological modernization, but not all in the same way. The concept of ecological modernization has appeared in distinct contexts, which has led to some confusion as to what is exactly meant by ecological modernization (theory). Two categories of distinction aid clarification. First, a distinction should be made between
ecological modernization as a theory on social continuity and transformation and ecological modernization as a political programme for change, that is for environment-inspired reform of contemporary industrial society. The two denotations are interdependent, but should be separated analytically. Authors like Udo Simons (1989), Albert Weale (1992) and Mikael Skou Andersen (1994) have each made significant contributions to the definition and promotion of a political programme of ecological modernization as the new agenda for western European environmental politics. Environmental sociologists, on the other hand, have constructed a social theory labelled 'ecological modernization' (cf. Huber, 1982; Spaargaren and Mol, 1992; Wehling, 1992; Jänicke, 1993; Hager, 1993; Mol, 1995). Starting from an analysis of changing social practices in production and consumption, environmental politics and environmental discourses, the latter have constructed a theoretical approach to generate a sociological understanding of transformations in contemporary industrial societies in dealing with ecological challenges. A second analytical distinction should be made between the analytical/descriptive and the normative/prescriptive conception of ecological modernization. Although Goodin (1992: 22) seems to believe otherwise, the two dimensions or denotations of a theory can in principle be separated, although they are usually closely interrelated in social theory. The analytical/descriptive conception provides a coherent and consistent set of specific concepts and ideas for adequately characterizing and analysing the way contemporary industrial societies (are trying to) cope with the environmental crisis. Most of the critical references to ecological modernization theory primarily aim at its prescriptive undertones, and question the feasibility and desirability of such a normative course or project for environmental reform. These critics question the assumption that if, and only if, modern society follows the path set out by ecological modernization theory, the ecological crisis can be controlled and eventually solved in an acceptable way.

These different connotations do not mean, however, that the core features of ecological modernization theory cannot be formulated. In formulating them, we limit ourselves to the domain of production. According to Zimmerman et al. (1990), Huber (1991), Spaargaren and Mol (1992) and Jänicke (1993), among others, ecological modernization is, above all, a concept dealing with the institutions of modern technology, (market) economy and state intervention. It has been developed and refined in a constant debate with other social theories on environmental reform, such as Risk Society theory, so-called postmodernist theories (cf. Bauman, 1993; Gare, 1995), neo-Marxism and counterproductivity theories. We will consider four characteristics.

First, ecological modernization theory identifies modern science and technology as central institutions for ecological reform (and not in the first place as the culprits of ecological and social disruption). Science and technology are principal institutions in ecologizing economy. In the era of reflexive modernity and in confrontation with the ecological crisis, scientific and technological trajectories are changing. The simple end-of-pipe technological regimes, that were criticized so strongly in the 1970s (for example, Jänicke, 1979), are increasingly being replaced by more advanced environmental technologies that not only redirect production processes and products into more environmentally sound ones, but are also starting to be engaged in the selective contraction of large technological systems that can no longer fulfill stringent ecological requirements. In that way technological measures within ecological modernization are not limited to 'just another artefact'; and technological-fix criticism – so often addressed to ecological modernization theory (cf. Hannigan, 1995: 184) – is therefore hardly adequate.

Second, ecological modernization theory stresses the increasing importance of economic and market dynamics in ecological reform and the role of innovators, entrepreneurs and other economic agents as social carriers of ecological restructuring (in addition to state agencies and new social movements). In doing so it antecedes and is in line with the Brundtland concept of sustainable development (cf. WCED, 1987) in rejecting the fundamental opposition between economy and ecology. Economic development and ecological quality are interdependent but not antipodal or incompatible in a simple monocausal way, as was proclaimed in the 1970s. Environmental improvement can go together with economic development via a process of delinking economic growth from natural resource inputs and outputs of emissions and waste, although, in order to do so, the nature, content, pace and geographical allocation of this economic growth will have to alter fundamentally. Modern economic institutions and mechanisms can be, and are to an increasing extent, reformed according to criteria of ecological rationality. Along similar lines of argument, social theories on environment-informed legitimation crises in capitalist economies are challenged. As Albert Weale (1992: 89) claims, the theory of ecological modernization points to the fact that the conflict between legitimate state action on the environment, and related mass loyalty, on the one hand, and the imperative of capitalist accumulation, on the other, is not as fundamental as was once thought. The internalization of external effects via economizing ecology is one of the mechanisms put forward within the project of ecological modernization (cf. Andersen, 1994), in addition to the articulation of environmental 'standards' in economic processes by insurance companies, credit institutions, (industrial) consumers, certification organizations, branch associations, and so on.

A third distinction between ecological modernization theory and other social theories on environment and modernity relates to the state. Following the discussions on state failure in, among other things, environmental policy (cf. Jänicke, 1986), ecological modernization amends the traditional central role of the state in environmental reform. Although ecological modernization is critical of the role of a strong bureaucratic state in the redirection of processes of production and consumption, it does not deny the indispensability of the state in environmental management, as some of the theory's critics assert. Rather, the role of the state in environmental policy is changing, or will have to change, from curative and reactive to preventive, from 'closed' policy making to participative policy making, from centralized to decentralized, and from dirigistic to contextually 'steering'. Moreover, some tasks, responsibilities and incentives for environmental restructuring are shifting from the state to the market. Private economic actors become involved in environmental reform, for instance by certification of products and processes, by asking for environmental audits and by competition on environmental performance and the creation of niche markets. Leaving fewer – be they essential – elements of environmental policy making to the central state and changing the interrelation between state and society/economy, prevents the state from becoming an environmental Leviathan (cf. Paehlke and Torgerson, 1990). Following his earlier analysis of state failure, Jänicke (1993) has most strongly underlined this changing role of the state in environmental policy making by emphasizing the process of political modernization along the lines mentioned above, as part of a process of ecological modernization. Others have referred to similar tendencies in using the concept of reflexive governance (cf. LeBlansch, 1996).

Finally, the reorientation of state and market in ecological modernization theory also modifies the position and role of social movements in the process of ecological transforma-
At the company level environmental management systems have been established within the majority of chemical industries, coordinated by environment, health and safety officers and departments within these companies. The monitoring and management of the inflow and outflow of material and energy is increasingly becoming an integral component of company strategy, parallel to financial/capital monitoring and management and human resources management. This has resulted in the introduction of new instruments such as annual environmental reports, environmental certification systems and environmental audits. Special environmental officials have been appointed to translate general environmental requirements—often set by governmental agencies—into specifications and criteria for all company activities and outputs. Company expenditures on environmental measures and investments have increased during the last decade, both in absolute terms and as a percentage of the economic company results (Commission of the European Communities, 1993). For contemporary chemical industries, expenditures on environmental measures of up to 10 per cent of the total annual investments are the rule rather than the exception, and this percentage is expected to increase in the near future. In addition, research and development (R&D) resources have been reoriented towards the environment. In sectors such as the pesticides industry, R&D resources devoted to the environment have rocketed, but the expansion has been considerable in other chemical sectors, too. Although there exists some variation in the definition of environment-oriented R&D, most authors and chemical firms claim that 30–80 per cent of company R&D costs are related to the protection of the environment. Furthermore, as managers of chemical companies indicate, the development and introduction of new products without a corresponding environmental benefit will be vetoed in the internal decision-making process, because the commercial risks are too high. Ex ante ecological evaluations of new products (sometimes via life cycle analysis) and environmental audits of production sites have become standard practice, resulting, for instance, in modifications in the kind of raw materials applied and the design of new production processes. In addition, chemical industries have engaged in new activities. For instance, polymer producers have introduced research programmes to investigate new plastics-recycling technologies such as chemical recycling; many of them have acquired a majority share in plastics recycling companies (APME, 1992). These technoeconomic and organizational changes at the company level can no longer be seen as small adaptations of a continuing economic development path. They should rather be interpreted as the precursors of transformation processes that move beyond the individual firm.

At the sectoral level, the environment is increasingly becoming a factor in the competition between chemical companies. Some examples make this clear. Low organic solvent paints (water-based paints, high solids, radiation-cured systems, and so on) increasingly challenge the market for traditional organic solvent paints. While the production of low organic solvent paints was initiated by some small niche market firms, nearly all the major paint industries have by now switched to the expanding market of these new paint systems. Some small traditional paint companies are not in a position to generate the resources and expertise to develop such new, ecologically more sound paint systems, and evidence is emerging of the takeover or collapse of these small, traditional, often family-owned, firms. Producers of PVC plastics have seen their market share decreasing, in favour of other commodity polymers such as PP and PE. The unsatisfactory environmental performance of PVC—in the view of some sectors of society—is the main cause of this shift in market shares, especially in Germany, the Netherlands and Denmark. In addition, recycling requirements
affect the product development and polymer choice of plastic manufacturers and industrial end users such as the motor industry. This results in a diminishing variation of polymers in products and the emergence of fixed contracts between polymer producers, industrial end users and recycling companies, limiting free competition. The primarily environment-induced growth in resources and time spent on R&D and the (obligatory) registration of pesticides have resulted in an acceleration in (de)merging and joint ventures in the 1980s among pesticide industries (cf. Mol, 1995). Consequently, active ingredient production, has almost disappeared from the Netherlands, to become concentrated in France, Germany and the UK.

Besides these new frontiers of competition, environmental cooperation within the chemical industry has been augmented. In particular, branch associations – at both the national and the EU level – have stepped up their environmental activities and often doubled their staff to fulfill environmental tasks and services. Negotiations with regulatory agencies on the environment are often coordinated by branch associations, as are public relations and communication with other interest organizations. In addition, branch organizations have begun to engage in the translation of regulatory requirements down to the level of individual companies, to some extent evolving into a kind of neocorporatist organization in environmental policies.

As has been suggested above, this ecological restructuring can be understood as the growing importance of ecological factors and arguments in industrial development vis-à-vis economic ones, although the latter of course will remain dominant for some time. With reference to the chemical industry, this increasing importance of ecology in industrial transformations can be noticed in various mechanisms. Within the market for chemical products, the environment has become a relatively independent factor which cannot be reduced to economic factors. Actors within the market for environmental products articulate demands from both economic and ecological points of view; traditional economic and quality criteria have been extended to include environmental standards. Consumer organizations are widening their product quality tests, evaluations and advice with environmental criteria. Customers not only ask for environmentally sound products, but are starting to expand their demand to include environmentally sound chemical production processes by asking for certified environmental management and audit schemes. This new dimension of consumer/customer demand is paralleled by new marketing strategies, new product information standards, changing advertisement designs, and so on. The environment has emerged as an independent factor not only on product markets but also on financial markets. Insurance companies normally carry out an environmental audit before they insure chemical industries. Specified requirements must be met before a company is insured. In some cases, financial organizations such as banks make investment loans conditional on an environmental evaluation. However, chemical producers should not be seen as purely reactive actors, confronted with an ecologized market demand. They have partly created this ecologization of the market, for instance, since specialized chemical producers identified it as a niche market.

If we are looking for the mechanisms that move this process of ecological restructuring within the chemical industry, we can identify several interacting social forces. Besides the above-mentioned economic demand and supply factors, governmental measures, public pressures articulated by NGOs and international developments are among the most relevant dynamics forcing environmental transformations. The role of the state is touched on only briefly here, in order to concentrate on environmental NGOs. Governmental interventions have a dual aspect. Partly they follow the traditional line of command and control, and partly they are changing to more communicative and negotiation strategies, in which long-term agreements with the chemical sector are made on general environmental goals, taking the sector’s knowledge, preferences on time paths and kind of technological measures into account. A more indirect way of governance is increasingly used. Liability policy, for instance, has stimulated some chemical companies to use white lists instead of black lists for chemical substances allowed in their products. The division between the two modes of intervention differs from country to country, depending among other things on policy style and political culture.

A central characteristic of contemporary ecological reform is that the quest for environmental improvements does not have to be explicitly expressed and enforced by the state continuously, as the environment has become institutionalized to some extent in economic practices, as the example of liability policy shows. This institutionalization would become even greater if the most powerful mechanism in capitalist market institutions was mobilized on a larger scale: prices. Until now, price differences according to ecological standards have been introduced only marginally by regulatory organizations (for instance, by means of different VAT percentages, taxes or deposit systems). Until now, the resistance of the major chemical producers to such reforms has been rather effective.

In spite of the improved ecological performance of, and the institutional transformations within, the chemical industry, feelings of insecurity and anxiety remain in lay perceptions of these large-scale and complex chemical–technological systems. Various polls by both independent scientific institutions and chemical interests associations indicate a persistent negative public attitude to chemicals and the chemical industry because of their environmental risks. Risk assessments, life cycle analysis and scientific–technological control and management of the chemical industry’s expert systems are challenged time and again by counterexpertise and newly available information, as well as by chemical accidents. And these challenges are now on a global scale. While in the 1950s and 1960s chemical dangers and risks were primarily of local origin, the 1980s witnessed an increasing globalization of chemical risks via food and commodity chains, international transportation of (bulk) chemicals and global ecological interdependencies. The adherents of Ulrich Beck’s Risk Society theory may rightly conclude that the confrontation with chemicals and chemical production in almost every aspect of daily life has not resulted in an unquestioning, basic trust in the chemical industry. But on the other hand, no massive movement away from a ‘chemicalized’ lifestyle can be identified, nor a fundamental distrust of the scientific foundations underlying the development of the chemical industry. Protests against the plasticized throw-away society in the 1970s have been transformed into scientifically informed analyses and counterexpertise on various (chemical) product and processing alternatives. And the current environmental NGOs’ plea is for the change to a sustainable chemical industry rather than for a dismantling of chemical production, so characteristic of the 1970s. Only in the (natural) food sector do we see serious initiatives to abolish chemicals, mainly pesticides and chemical fertilizers.

It is essential to underline that the above analysis and evidence do not mean that the chemical industry is no longer challenged on its ecological performance, or that we are advancing the possibility of a sustainable chemical industry in the near future. This is far from being the case, as most figures and data on emissions and environmental quality parameters show. But the analysis does indicate that, first, transformation processes in the
chemical industry are to a significant extent environment-informed and, second, this ecological transformation is a process of radical modernization involving (and transforming) the institutions of modernity. In this sense this ecological restructuring of the chemical industry resembles what has been labelled the 'modernization of modernity', while other, alternative ways out of the environmental predicament seem to come to a dead end, as will be made evident in the next section.

**Soft Chemistry: A Stagnating Alternative to Restructuring**

The most clearly defined alternative to an ecological modernization of the chemical industry is the idea of soft chemistry. Soft chemistry (*sanfte chemie*) is the chemical equivalent of Lovins' soft energy path and is akin to Ulrich's alternative of sackgasse technology (Lovins 1977; Ulrich 1979: 149ff). Soft chemistry moves away from some of the central characteristics of modern technological systems and revitalizes the environmental concepts that were prominent in the early 1970s, albeit with a modern outlook.

According to von Gleich (1988, 1991), one of the founders and interpreters of the soft chemistry paradigm, three criteria can be used to distinguish soft from hard chemical (or nuclear or genetic) science and technology. First, soft chemical technology distinguishes itself from its antipode by intervening only superficially, less 'profoundly', in chemical structures. The increasing profundity of intervention (*Eingriffstiefe*) of hard chemical technology has three consequences: increasing power of man over nature, increasing risk potentials due to extended time-space dimensions and irreversibility, and a widening gap between the scope of our knowledge of nature and the scope of our intervention in nature. The fact that the intervention level of soft chemistry is less deep does not mean that these technologies are without problems, but rather that they have retained a use-dependent neutrality: negative consequences of the use of this technology are not inherently related to technology itself but rather to the application of the technology. Second, soft chemical technology can be distinguished by its instrumental character (*Werkzeugcharakter*), that is the possibility for labourers (the primary producers) to use and control the natural properties of the natural resources used in production. While hard chemical technology has to use standardized and uniform natural resources and Fordist production processes, in which primary producers and natural resources are adapted to production technology, soft chemical technology—in contrast—is adapted to the properties of the natural resources as they are found. Finally, soft chemical technology makes use of the coproductivity (*Mitproduktivität*) of nature instead of interpreting nature as a mechanical/cybernetic compound. Biological and ecological processes are part of chemical production. Chemical production technology should not mean the exclusion of nature and biological/ecological processes.

The idea of soft chemistry has hardly found any application in contemporary chemical industry and chemical products. The production of so-called 'natural paints' is generally seen as the most important and promising soft chemical technology, but even during the third wave of environmental consciousness in the late 1980s and early 1990s the market for natural paints stagnated and did not rise above a 1 per cent share of the market in European countries. State programmes in, for instance, Germany and the Netherlands aimed at the environmental improvement of paints and the paint industry have been hesitant to support natural paints, because of their inferior product quality, their poor environmental performance on volatile organic compounds and the risk of endangering the good relations with the regular chemical paint industry. Moreover, in criticizing the chemical industry, most of the environmental movements in Germany and the Netherlands have not founded their ideology on soft chemistry, but have pleaded, instead, for an environmental modernization of the chemical industry. Natural paints have only been advocated by a small proportion of the environmental movements, and have sometimes even been subjected to fierce criticism from an ecological point of view by environmental organizations. In other chemical sectors and products, soft chemistry plays an even more limited role.

In conclusion, it can be asserted that soft chemistry, as a way out of the environmental crisis caused by the chemical industry and an alternative to ecological modernization, seems to have lost both its descriptive powers and its normative value for major parts of the environmental vanguard of modern industrial society.

**EPILOGUE**

In the process of environmental reform of one of the most challenging sectors (from an ecological perspective) of modern society, the institutions of modernity are by no means fading away. Although other economic sectors will show to some extent differences in their path of ecological reform, the general processes, dynamics and institutions involved will be broadly similar.

In this reform process the ecological question reflexively transforms these institutions by making their 'linear' economy–technology–oriented progress difficult. Ecological problems seem to be one of the major issues that contribute to a more reflexive process of modernization, in which current institutions are constantly questioned and transformed. In that sense modernity has lost its innocence and we are definitely entering a new phase of modernity, labelled by different authors as 'late' or 'reflective' modernity. However, it is going one step too far to designate this new phase 'postmodernity', as all the major institutions of modern society are still dominant. The fact that ecological considerations play such an important role in this transformation process is increasingly recognized by sociologists, and is reflected in the growing attention paid to ecological issues by general sociological theory, as we have observed in the introduction.

It is of course not only ecological modernization theory that profits from this increasing attention that sociological theory pays to the environmental question. Risk Society theory and various versions of a postmodernist idea of environmental reform, to name but a few, have also taken advantage of these theoretical developments. Although this will definitely not lead to a uniform and dominant social theory for analysing and understanding current (and reflecting on future) environmental reform, it has already improved the quality of the theoretical and societal debates on these issues, as compared to those of the 1970s. Maybe that is one of the major steps forward in modern environmental sociology.

**NOTES**

1. Goldblatt (1996) recently reopened this debate by questioning Giidden's conceptualisation of the environment in relation to the industrial rather than the capitalist dimension of modernity. According to Goldblatt, Giidden deals only superficially with environmental degradation in hardly paying attention to the capitalist mode of production as its basic source, in addition to industrialism.
2. The ideological vanguard of especially Dutch and German environmental organizations and political parties have contributed on a more practical level to the political acceptance of the idea of ecological modernization. See, for instance, Schöne (1987), Fisher (1991), Friends of the Earth Netherlands (1991) and van Driel et al. (1993).

3. For an elaboration on ecological modernization theory with respect to the sphere of consumption and lifestyle: Spaargaren (1996).

4. Mol (1995: 7-26) has analysed the different schools of thought in environmental sociology from the late 1960s onward.

5. The bureaucratic state environmental policy of the 1970s and 1980s is regarded as inflexible, economically inefficient and unjust, slowing down rather than propelling technological innovations, unable to control the billions of material and energy transmutations occurring each day and incapable of stimulating progressive environmental behaviour by companies (for example, Jänicke, 1986; Huber, 1991).

6. PVC = polyvinyl chloride; PP = polypropylene; PE = polyethylene.

7. Production of the first-generation pesticides that have become so notorious in Western societies because of their ecological side-effects, is no longer under patent and is seen in so-called ‘Third World’ countries.

REFERENCES


